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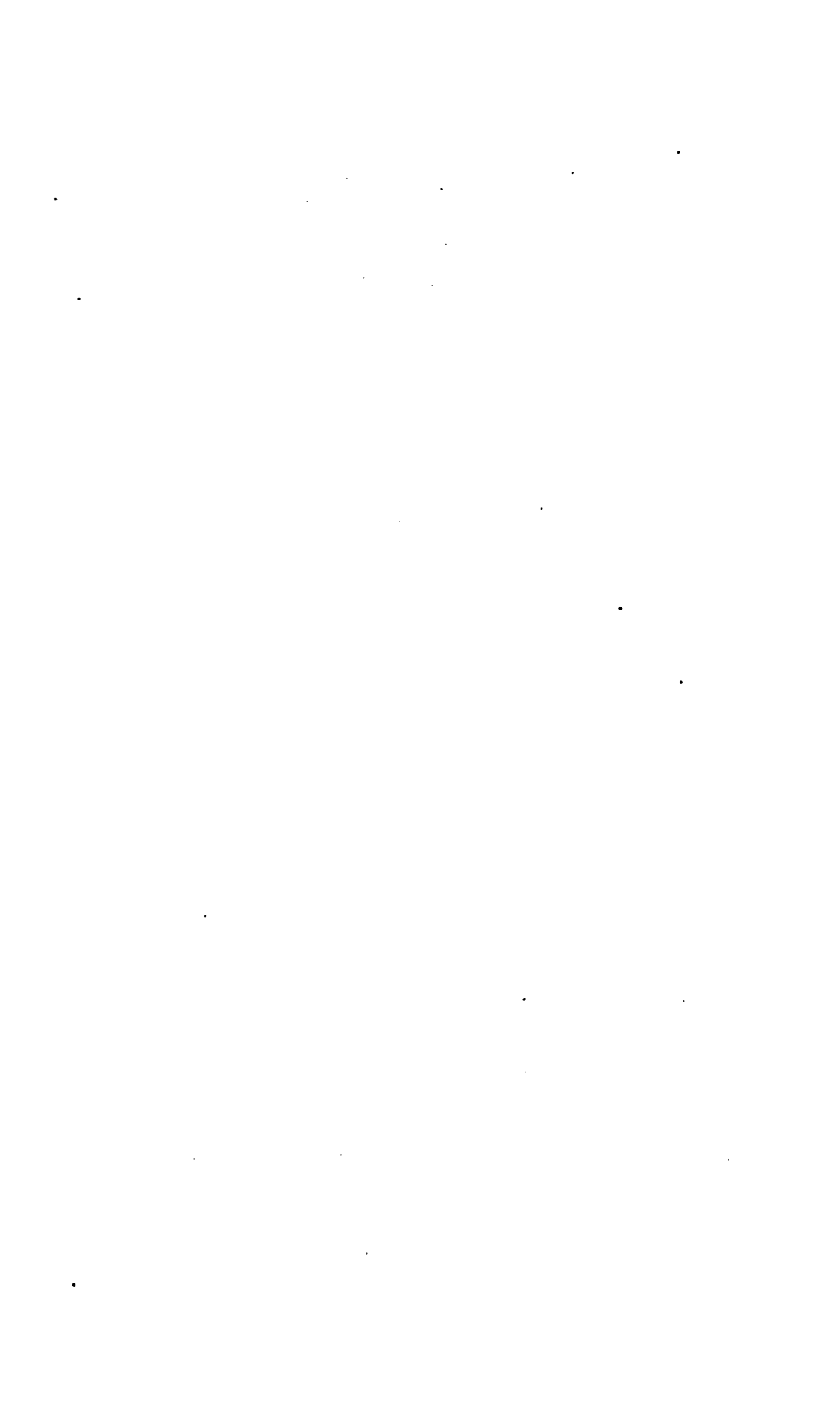


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DISEASES
OF
THE OVARIES

BY
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DISEASES OF THE OVARIES.

CHAPTER I.

ANATOMICAL CONSIDERATIONS.

IN the earliest period of foetal life the sexual gland develops at the side of the spinal column, on the inner side of the Wolffian body, and about the tenth week it begins to present a different appearance in the two sexes. The ovary is longer and flatter than the testicle, and at the same time assumes a more oblique position. After the ovary is somewhat more developed, a reduplication of the peritoneum (mesovarium) forms and connects with the Wolffian body. According to H. Meyer, the length of the ovary in a ten weeks' foetus is 3.8 mm., in a twenty weeks' foetus 12 mm., in the mature foetus 20 mm. The left ovary is smaller than the right. (H. Meyer and Hennig.)

Like the testicle the ovary also descends, but during the greater part of foetal life remains at the level of the false pelvis, and it is not until the last months that it reaches the inlet of the true pelvis. For some time afterwards both ovaries remain behind the uterus, slightly separated from one another.

According to A. Kölliker, the descent of the ovaries is explained most plausibly by the assumption of a difference in the rapidity of development of the organs lying above and below the ovary, in like manner as the lower part of the spinal cord ascends from the sacral canal to the second lumbar vertebra. At all events, the gubernaculum Hunteri plays no part in the descent of the ovaries.

After birth the mesovarium forms a fold of peritoneum, which is composed of the posterior layer of the broad ligament. The ovary is not covered with peritoneum, but, in very great part, is pushed through an opening of the peritoneum into the peritoneal cavity, and, apart from the fimbriated extremity of the Fallopian tube, is the only organ situated within the peritoneal cavity. Only a small portion of the organ is situated between the folds of the broad ligament. The peritoneum ceases to

form the covering of the organ along a jagged line which is visible to the naked eye. The covering is formed by a layer of cylindrical epithelium cells, arranged like a beautiful mosaic, and distinguished by their greater size from the flatter endothelium of the peritoneum. The epithelium on the surface of the ovary (germinal epithelium of Waldeyer), although not ciliated, is probably identical genetically with the epithelium of the Fallopian tube, but is not directly continuous with it. Between the epithelium of the fimbria and the germinal epithelium, there is generally a more or less broad band of peritoneal endothelium.

The fœtal structure of the ovary is constituted in the following manner: The elongated flat organ in the embryo contains two layers; the upper



FIG. 1.—NORMAL GENITALIA, (with the aid of Henle's illustration.)

parenchyma layer and the vascular layer situated beneath it. It is only in extra-uterine life that the well-known almond shape is produced by the rolling-up of the organ, and at the same time the vascular layer becomes internal (medullary substance), the parenchyma layer external (cortical substance). Towards the lower border is the entrance of the vessels (hilus) within the broad ligament. In this part alone a small portion of the vascular layer is still situated at the surface of the organ.

Before these changes of form occur, the structure of the ovary develops in the following manner: In the fourth month of fœtal life the germinal epithelium of the surface and the underlying stroma of the parenchyma zone undergo a process of adhesion, by which balls of epithelium enter the stroma. These inter-communicating balls of epithelium are imperfectly separated from one another by connective tissue,

and form a sort of tube, but with numerous defects; some possess outlets at the surface of the organ. Certain of the cells situated in these tubes are soon distinguished by unusual size, and a large nucleus (ova). The ova are gradually isolated, and acquire their own receptacle (Graafian follicle). This is owing to the fact that connective tissue proliferates between the individual ova, and with each ovum a number of other epithelium cells also separate, and become the epithelium of the follicle. The isolated ova are situated internally and near the vascular layer; the ova which are aggregated in large balls are situated more towards the surface.

This view is in accordance with that of Waldeyer, who claims that the epithelium of the follicles is derived from the germinal epithelium. He believes that they take their origin from migrating cells; Foulis, from the stroma cells of the ovary. Finally, Kölliker assumes still another mode of origin of the granular cells. He describes tubes and cell strands in the hilus of the ovary. These strands are connected towards the parenchyma layer, with the ova clumps, and extend to the surface of the ovary. Near the hilus they are sharply defined, but, as they are connected with tubes containing a lumen, they can be derived from the Wolffian body alone. In one case, Kölliker was able to follow, in the ovary of a cat, the continuation of the medullary strands into the Wolffian body. Hence, Kölliker claims that the cells of the membrana granulosa and the ova differ in their origin.

The mature Graafian follicle presents the following structure: Its wall, theca folliculi, has a double layer, an outer more fibrous structure (tunica fibrosa), and an inner one (tunica propria) which is richer in cells and granules; they are approximately equal in thickness. The tunica propria carries upon its inner surface one or more strata of cylindrical epithelium (membrana granulosa) which are accumulated in greater numbers in one spot (discus proligerus). In these the ovum is imbedded. The cells of the discus proligerus, which are situated nearest to the ovum, are applied to the membrane of the latter in a regular radiating manner. Liquor folliculi does not accumulate until the follicle is maturing. The latter very rarely contains two ova. The follicles are at first aggregated in groups,—primary follicles. The mature ones gradually extend inwards, and may finally reach the vascular layer.

The primary follicles are found as early as the 16th week. The epithelium and the wall are still imperfect. About the 30th week the epithelium cells form a complete corona. Their full development, with a discus proligerus, takes place at a later period,—according to Waldeyer, not until $1\frac{1}{2}$ years after birth. Bischoff has seen mature follicles in the new-born, Négrier during the first year of life. The majority of authors regard these as pathological. H. Meyer assumes that such follicles either perish or degenerate pathologically.

The primary follicle is firmly adherent to the surrounding tissues, the mature follicle is readily enucleated from the latter. This is owing to the development of a rich system of blood-vessels and lymphatics at the periphery of the mature follicle (His).

DISEASES OF THE OVARIES.



FIG. 2.—OVARY OF A GIRL AET. 3 DAYS. (After H. Meyer.)

The number of follicles at the period of puberty is by no means always very small. On the average, their number is greatest (50-100 in each ovary) during pregnancy.

The ovum consists originally of the nucleus and nucleolus (*vesicula* and *macula germinativa*) and a small amount of protoplasm (germinal yolk). At a later period, the cells of the *membrana granulosa* form the *zona pellucida*, which contains fine radiating streaks, and has a double contour. A micropyle has not been found in the human ovum, or in that of the higher vertebrates. (Pflüger described it in the ovum of the cat.) The ovum is never situated in the centre of the follicle, but is always imbedded, with the *discus proligerus*, in that side of the follicle which is farthest from the surface of the ovary (Pouchet, Schroen). Sappey estimates the number of ova in an ovary at 36,000, Sappey at 400,000, whence it is evident that the immense majority perish in a rudimentary form.

The formation of the ova and the sinking in of the superficial epithelium into the stroma, in order to form egg-balls, may be generally regarded as finished with the termination of foetal life, or a little later, but the separation of the ova and the conversion of the egg-balls into follicles by intervening stroma, are not completed until a couple of years after birth. Koester observed exceptions to this rule. In a grown girl and in three women after delivery, he found depressions of the germinal epithelium into egg-balls. How frequent this process is in later life, and whether it may then be regarded as physiological, is a matter of question. Sinéty has recently maintained that at the period of birth, and shortly afterwards, in the new-born, there is an acute progress in the development of the Graafian follicles, many of which then become visible to the naked eye. Slavjansky saw such mature follicles in children a week old, Sinéty in a still-born child, Raciborski in a foetus of seven months. This acute advance in development is followed by an almost complete standstill, which lasts until puberty. This is analogous to what happens in the mammary gland at birth, and also, according to Merkel, in the testicle. If Sinéty's statements should be confirmed, certain recent views concerning the development of certain cystic formations in the ovary would be almost entirely deprived of foundation. In opposition to the view of the permanency of foetal egg-balls, Haussmann found not infrequently a premature development of follicles, and is inclined to associate this with subsequent amenorrhœa and sterility.

The ovary has a connective-tissue stroma, which, in the adult woman, contains numerous spindle-cells in the central parts alone, and near the surface is purely fibrous. In the foetus and new-born, the organ does not possess an albuginea. This forms gradually after birth, because the cells of the outer portion of the parenchyma layer migrate to the interior as ova or follicular epithelium. The layer beneath the superficial epithe-

lium thus becomes poor in cells, and is known as the albuginea. It is present before puberty, but continues to increase for a long time in density and thickness.

Whether smooth muscular fibres are found in the ovary outside of the sheaths of the vessels, or whether they belong exclusively to the latter, has not been positively determined.

The arteries of the ovary are six to eight in number, and are derived from the arches formed by the anastomosis of the uterine and internal spermatic arteries. They run between the folds of the broad ligament, and are twisted like a corkscrew. This appearance is maintained in the stroma itself, in which they are most abundant at the boundary of the parenchyma layer. The veins are also convoluted; they form a dense coil in the hilus, and empty their blood partly into the uterine veins, partly through the pampiniform plexus into the spermatic vein.

The lymphatics are very numerous, and leave the ovary with the veins to empty into the uterine plexus and the plexuses situated on the iliacs. His and Slavjansky also found lymphatics in the theca folliculi. Exner and Buckel deny the existence of lymphatics in the ovary. According to them the lymph flows only in the interstices of the stroma.

Frankenhäuser states that the nerves enter the hilus as two fine twigs of the ovarian plexus, and branch dichotomously with the vessels in the stroma. H. Meyer was unable to detect their final ramifications, but Elischer claims to have followed the finest fibres to the cells of the membrana granulosa and to have seen their termination in the cell nuclei.

It remains for us to consider the rupture of the follicle. Every follicle, which approaches maturity, presents in its wall a spot which is destitute of blood-vessels and lymphatics (stigma folliculi). Here the rupture of the wall occurs. After a certain amount of fluid has collected in the follicle, the latter appears, in great part, to undergo rupture on account of profuse cellular infiltration into the epithelial layer and theca folliculi, with free emigration of cells from the latter. According to Rindfleisch the membrana granulosa secretes a substance (paralbumin, colloid) which swells to such an extent as to cause rupture.

After the escape of the ovum the corpus luteum forms, chiefly on account of the previously mentioned cellular proliferation in the theca folliculi. This pushes off the membrana granulosa near the centre, and at the same time throws it into folds by means of vascular arches which enter it. With the new-formed vessels giant cells also appear. The cells of the membrana granulosa are in part destroyed, in part they are converted into lutein cells by distension of the cell body. At the same time they undergo fatty degeneration. Within the folded yellowish membrana granulosa, the corpus luteum contains a reddish, later yellowish centre. In exceptional cases, the central portion forms a cavity containing blood or serum. The centre is generally a solid mass,

and consists of connective tissue, formed from the emigrated cells and the vessels which have entered from the walls of the follicle. The centre is always connected directly with the site of rupture of the follicle and of the surface of the ovary.

His lays stress on the abundance of lymphatics in the corpus luteum, even in its central portion. The yellow color of the convoluted, peripheral layer depends upon colored fat, which is soluble in chloroform, and does not contain iron.

An extravasation of blood, during or previous to the rupture of the follicle, occurs not infrequently, however, into its cavity. If it is considerable it prevents the proper development of the stratum luteum, and is undoubtedly a frequent cause of destruction of the ovum. Under the influence of the entering vessels, the fibrin is often converted into connective tissue, and gives rise to the formation of circumscribed small



FIG. 3.

FIG. 3.—TYPICAL CORPUS LUTEUM; fifteenth day from the beginning of menstruation. (After Leopold.)



FIG. 4.

FIG. 4.—FRESHLY RUPTURED FOLLICLE; twenty days after beginning of last menstruation. (After Leopold.)

fibromata. In other cases cystic formations are produced. After extravasations into the follicle hæmatoidin is generally found, usually enclosed in cells.

If conception occurs, the corpus luteum, as a result of the hyperæmia of the organs, undergoes considerable development, which continues to the end of pregnancy (true corpus luteum). It is largest about the eleventh week of pregnancy. If conception does not take place, it rapidly becomes smaller, and its centre bright and shining (false corpus luteum).

The two forms cannot always be distinguished with facility. It is not known how long the false corpus luteum is retained in the ovary. Kölliker found, in addition to a fresh corpus luteum with a menstruating uterus, two old ones, one 5 by 2 mm., the other 3 by 1 mm. in size. As the woman had never been pregnant, they must have been left over from previous menstruations.

A large number of follicles are destroyed by shrinking. These form cicatricial shining bodies, like the later stages of corpora lutea, and in which the membrane of the follicle is often found lying in folds. In larger shrunken follicles Waldeyer was quite commonly able to detect the perishing ovum as a compressed zona pellucida, with granular contents. Shrunken follicles of this kind are found even in the new-born (Henlé.)

In shrinking of the follicles the germinal spot first disappears. In its stead the germinal vesicle contains a number of small, shining and angular clumps (carbonates). The germinal vesicle and yolk may also undergo the same process. Finally, the zona is destroyed by the proliferation of granulosa cells.

The ovary presents a very variable form, and does not always occupy the same position. It is most often shaped like a compressed ovoid, the tubal surface of which is much flatter than the other. The lateral extremity is rounded, the median extremity more pointed. The border situated within the folds of the broad ligament is straight, the free border more convex.

The organ may also be elongated, spindle-shaped, or almost spherical, or it is abnormally flat, short and high. According to Luschka, the average measurements of the ordinary form in young women are: length, 4.0 cm.; width, 2.2 cm.; thickness, 1.3 cm. But the size is extremely



FIG. 5.—SENILE INVOLUTION OF THE OVARY AND UTERUS. Natural size. Left ovary, 12 mm. long, 10 mm. broad.

variable. According to Chéreau the weight in adults varies from 5 to 8 gm.; according to Dalton, from 2.75 to 8.20 gm. (average 5 gm.).

With advancing age the albuginea thickens and divides into numerous layers, and the ovary becomes firmer and tougher. At the same time its surface, on account of the rupture of numerous follicles, presents a large number of cicatricial retractions, which are closely aggregated in curved, often S-shaped lines. After the menopause the organ is reduced to one-half or one-third its previous size, and not very rarely diminishes to the size of a small hazel-nut. The weight falls from 6 gr. to 3 to 1½ gr. According to Kisch the cells of the follicles undergo fatty degeneration in senile involution. The follicle collapses and is replaced by retracting connective tissue.

Among the connections of the ovary with adjacent organs must be mentioned, in addition to the peritoneal reduplication described on page 1, the ligamentum ovarii. This connects the inner extremity of the

ovary with the uterus, into which it is inserted immediately behind and below the entrance of the Fallopian tube. This ligament is a very firm, round cord, 2.5 to 3 cm. in length, and consists of connective tissue and smooth muscular fibres with a peritoneal covering. It prevents any marked separation of the ovary from the uterus. The lateral extremity of the ovary is connected with the Fallopian infundibulum by the infundibulo-ovarian ligament. This feeble connective-tissue membrane, which also supports the fimbria, prevents the separation of the abdominal end of the Fallopian tube from the ovary, and is prolonged into a quite long reduplication of the peritoneum (infundibulo-pelvic ligament) which extends from the fimbria to the posterior part of the iliac fossa. This ligament serves as a path for the spermatic vessels, along which they extend to the broad ligament and ovary. It produces a depression anteriorly (paravesical fossa) and one posteriorly (Douglas's *cul-de-sac*). It forms the upper and lateral boundary of the latter.

Position of the Ovary.—Each ovary is situated at the entrance to the true pelvis, and is parallel, to a certain extent, with the lateral wall of the pelvis. The free convex border is directed upwards, the border situated within the broad ligament is directed downwards. The tubal (so-called anterior) surface is directed to the side and somewhat anteriorly; the free, ventral (so-called posterior) surface is directed medially and posteriorly. The median extremity is directed anteriorly, the lateral extremity posteriorly. The fimbriated extremity of the tube curves around the lateral extremity of the ovary. On account of the close apposition of the tubal mesentery (the so-called *ala vesperitilium*) to the tubal surface of the ovary a slit-shaped peritoneal space (*bursa ovarica*) is formed between these two structures, and in its outer extremity is situated the fimbria of the Fallopian tube.

Each ovary is about 2 cm. from the corresponding horn of the uterus. This description of the position of the ovary holds good when the uterus is in a condition of normal anteversion. Erection of the uterus, such as occurs in distension of the bladder, changes the position of the ovary only in so far as it draws the median end slightly backwards; though it is still directed more anteriorly than the lateral extremity. In pathological retroversion, however, the tubal surface of the ovary may be in the frontal plane, or the median extremity may even be behind the lateral extremity. The latter is fixed in a measure by the infundibulo-pelvic ligament, which leaves the iliac fossa behind the transverse diameter of the entrance of the pelvis, and thus forms physiologically a sort of pivot for the movements of the ovary. The position of the body has little influence on the situation of the ovary. The only change of importance which the organ undergoes physiologically is its ascent during pregnancy. In advanced pregnancy one or both ovaries are often felt high up above the pelvis, and in close apposition to the uterus (generally the left ovary). This is

also true of the puerperal period, but the ovaries resume their normal position about the twentieth day after confinement.

Schultze showed that Hasse's statements, according to which the lateral extremity of the ovary is anterior to the median extremity, do not hold good in the living subject, but may be true with regard to dead subjects in whom retroversion of the uterus occurs so frequently. Kölliker agrees with Schultze, but states that there is probably a great physiological variation in the position of the ovaries. The rotation of the organ so that its free border looks downwards and internally is not regarded by him as pathological.

Palpation.—The non-enlarged, normally situated ovaries may be palpated in very many cases. If the individual lies upon her back, and the abdominal walls are relaxed, the left ovary can be palpated by introducing the left hand into the vagina and applying the right hand externally. One or two fingers of the left hand are pushed upwards, about midway between the border of the uterus and the pelvic wall. At the same time the external hand gently presses upon the abdominal walls, and feels for the inner border of the *psoas magnus*, where it covers the entrance of the pelvis. If the edge of the muscle is not felt distinctly, the thigh should be slightly flexed. The ovary is found alongside of the border of the muscle or below it. If the fingers of the hand in the vagina are directed towards the same region, the ovary can generally be felt between the two hands. It may slip away anteriorly or posteriorly, and again be caught. Thick abdominal walls, distended loops of intestines, or pathological conditions often render the palpation of the ovaries impossible.

The left ovary is palpated more readily than the right, perhaps on account of the dissimilar position of the two ovaries. Portal found that the left ovary was generally higher than the right, and attributed this fact to the slight inclination of the fundus uteri towards the right side. Freund found that the left ovary has a more vertical position in the foetus, and the transverse axis of the uterus is closer to the first oblique diameter of the pelvis, on which account the left border of the uterus with the adnexa is approximated more closely to the abdominal wall. Perhaps the distended rectum, which is situated behind the left ovary, also favors palpation.

Chéreau and Loewenhardt explore the ovaries by recto-abdominal palpation. This is often successful, and is advisable in those cases in which vaginal exploration is impossible or is unsuccessful on account of rigidity of the vaginal walls.

By means of G. Simon's rectal exploration with the half or whole hand the ovaries can be felt distinctly without external palpation. Much depends, in these examinations, upon the condition of the fasciae and ligaments, whose extreme relaxation in multiparæ is often very favorable.

The palpation of the non-enlarged ovary is most important in the diagnosis of chronic oöphoritis.

In the majority of cases normal ovaries are not tender on moderate pressure, though exceptions to this rule are not rare. Menstrual congestion seems to be a specially frequent cause of hyperæsthesia. According to Joh. Meyer, the ovaries are very often tender during menstruation, sometimes even enlarged.

The surface of the organ is generally smooth, but occasionally small prominences, which produce the impression of projecting follicles, are felt.

The majority of ovarian diseases occur during the period of sexual activity, *i.e.*, from puberty to the menopause. Cystoma and carcinoma may develop before puberty and also at the menopause and during old age. Constitutional diseases (syphilis, tuberculosis, scrofula, chlorosis), with the exception of morbus maculosus and allied conditions, hardly play a part in the production of ovarian diseases. More important are the acute exanthemata which give rise to parenchymatous diseases of the ovaries. Recent authors have described myxomatous degeneration of the ovary in leukæmia, but the relation between these conditions is obscure.

Much more important causes are furnished by the conditions incident to sexual life. The congestion accompanying menstruation and the puerperal condition are the chief causes of disease. Not alone inflammatory conditions but even the beginning of tumors develop not very rarely during the puerperal state.

Sexual intercourse, especially when excessive, is a cause of inflammatory affections, partly on account of the mechanical injury, partly on account of the congestion of the genital organs incident to sexual excitement. Onanism undoubtedly acts in a like manner.

But it cannot be maintained that sexual gratification and its sequelæ play a prominent part in the development of ovarian disease. This is evident from the fact that unmarried women are attacked with hardly less frequency than married women.

Very little can be said in a general way concerning symptomatology. Ovarian diseases present comparatively few symptoms. Three symptoms alone recur frequently.

1. Menstrual disorders. Even these are not very frequent in ovarian disease. Menorrhagia is sometimes observed in chronic inflammatory conditions, rarely in the first stages of tumors. Amenorrhœa is still rarer. It is rarely observed except in anomalies of development, cirrhosis of the ovary, and in bilateral tumors. Tumors of one ovary, even when they have attained a large size, are hardly ever followed by amenorrhœa unless the general condition is very much impaired. Carcinoma is an exception to this rule; the disease is generally bilateral, but cancer of one ovary is to produce amenorrhœa at a relatively early period. Ovarian dys-

menorrhœa is also rare. The pain is sometimes very severe and is distinguished from uterine dysmenorrhœa occasionally by its situation on one side, by the colicky character of the pain, and not infrequently by the fact that it lasts longer than menstruation. In other cases all the symptoms disappear at once as soon as the flow begins. In addition, certain menstrual periods may be unattended with pain, a feature rarely observed in uterine dysmenorrhœa. I have not observed, as Lawson Tait claims, that sub-mammary pain is much more frequent in ovarian than in uterine dysmenorrhœa.

2. Independently of the menstrual period, pain plays but a small part in ovarian diseases. It is the chief symptom only in oöphoritis and in the rare abscess of the ovary. In the majority of cases pains are not produced directly by the presence of tumors. As a rule, the pain in such cases is a symptom of secondary peritonitis, and therefore temporary, or is confined to annoying sensations, resulting from pressure and traction of the tumor. The pain is inconstant and often slight for a long time, even in cancer.

3. Sterility is frequent in chronic oöphoritis and its sequelæ, and in bilateral tumors. Unilateral tumors, even if very large, do not prevent conception in many cases.

Neuroses in various nerve tracts are much rarer in ovarian than in uterine disease, and are frequently observed only in chronic oöphoritis and changes in position of the ovary.

CHAPTER II.

ABSENCE, EXCESSIVE NUMBER AND RUDIMENTARY DEVELOPMENT OF THE OVARIES.

ABSENCE of both ovaries occurs in non-viable monstrosities, in whom the uterus is absent or very rudimentary, and the external genitals and vagina are also apt to be imperfectly formed.

The reported cases of absence of both ovaries in living and adult individuals can no longer be regarded as authentic, since it is known that the organ may be constricted by torsion of its ligaments and that the constricted organ may be fixed in other places and undergo marked atrophy.

Absence of one ovary is also rare, but much less so than that of both organs. As a rule one half of the uterus also remains rudimentary. The corresponding Fallopian tube is absent or rudimentary. The corresponding kidney is sometimes displaced downwards, but the supra-renal capsule does not take part necessarily in the displacement.

The absence of one ovary is not always associated with rudimentary development of the uterus. In some of these cases, however, the Fallopian tube is defective; its internal extremity is alone developed, its abdominal extremity is destitute of fimbria and obliterated. The majority, if not all, of these cases are produced by constriction of the organ and of the outer end of the tube by adhesions or torsion of the axis, a process which was demonstrated by Rokitansky even in normal ovaries.

Supernumerary ovaries, *i.e.*, two on one side, were first observed by Grohe and attributed to constriction after foetal peritonitis. The latter may be owing, in some cases, to hereditary syphilis. Klebs described a second case. The right ovary was divided by a band, 1.5 cm. in length and formed like the ovarian ligament, into two pieces containing rudimentary follicles. In Sinéty's case the ovary of a new-born child presented six to seven pedunculated appendages. All were cystic except one, which was solid and showed the normal ovarian structure. In this case the separation was not complete. A patient of mine, *æt.* thirty-six years, and who had borne three children, came under treatment for a large abdominal tumor.* I extirpated a multilocular tumor which looked like an ordinary ovarian cystoma, but had extremely thin walls and adhered to the posterior wall of the uterus (2 cm. behind the insertion of the

ovarian ligament) by a firm pedicle as thick as a thumb. After the death of the patient both ovaries were found in the ordinary situation but enveloped in dense fibrous bands. The pedicle of the tumor had not changed the substance or shape of the uterus, and was not connected with the broad ligament. As the tumor was formed like an ovarian cystoma and its thin walls were firmly adherent to the uterus alone, the case was undoubtedly one of constriction of a portion of the left ovary by peritonitis, the traces of which were very evident.

Since 1878 the number of cases of supernumerary ovaries has been considerably increased.

During an ovariectomy Keppler found a third ovary with a corresponding Fallopian tube. Kocks described the following case: During total extirpation of the uterus three ovaries were found, two on the left side. The supernumerary one was smaller than normal, 2 cm. long, 1 cm. broad, 0.75 cm. thick, and lay in the broad ligament between the uterus and the other left ovary. It had a distinct hilus, a cicatricial surface, and contained a freshly ruptured Graafian follicle. In Lumniczer's case of parovarian tumor, three ovaries were found, two on the side of the tumor. Both were as large as a hazel nut, and provided with follicles, but were held together by a band of atrophic ovarian tissue 5 cm. in length.

A case reported by Winckel presented very peculiar conditions. The third ovary lay upon the bladder in front of the uterus, and was connected with the uterus by a firm ligament 17 cm. long, which was inserted 1 cm. from the insertion of the Fallopian tube. The supernumerary ovary was 2.25 cm. long, 1.5 cm. broad and thick, and was larger than the normal ovaries. Under the microscope it showed ovarian structure. Signs of peritonitis were absent. In this case Winckel assumes that the germs of three distinct ovaries were present primarily, and suggests that the third ovary may have developed from that portion of the intestinal layer which forms the original cul-de-sac of the rectum, the allantois. The explanation in question is plausible for this unique case.

Some light is thrown upon the ordinary cases of supernumerary ovaries by Beigel's discovery of the appendages to normal ovaries consisting of ovarian tissue. Beigel found them eight times in 350 bodies, Winckel eighteen times in 500 bodies (*ovaria succenturiata*). Beigel found as many as three, Waldeyer even six, on one ovary. They are generally pedunculated and vary from the size of a hemp seed to 8 mm. in diameter. They are situated constantly upon the line, on the surface of the ovary, at which the peritoneal covering ceases. Their structure is similar to that of the normal ovary.

From their situation it is probable that the separation of ovarian tissue is connected with the descent of the ovary and its protrusion into the peritoneal sac. The supernumerary ovaries which, except in Winckel's cases, were always situated to the median side of the main organ, may be

regarded perhaps in part as a further stage of succenturiated ovaries, in part as the result of peritonitic constrictions.

Sin  y reports a case in which the stroma of the supernumerary organs was ovarian in structure, but was covered with ciliated epithelium which in places dipped into the substance of the organ. Peripherally were situated a few vesicles, which looked like Graafian follicles, but were destitute of ovula and were lined with ciliated epithelium.

Rudimentary ovaries are usually bilateral, occasionally unilateral. The ovary may be tongue-shaped, as in the f  tus, or its shape is normal, but it is atrophic. The essential feature is the imperfect structure. Graafian follicles are developed imperfectly or not at all, permitting a positive conclusion of disturbance of development during foetal life. According to Klebs, ovaries in which projection of the germinal epithelium into the stroma occurs, with final separation of these tubes from the surface epithelium, but without the development of ova and follicles, possess a certain similarity to testicles. Hence, if portions of an ovary are constricted and separated at the same time, cases of unilateral and bilateral true hermaphroditism are perhaps susceptible of another interpretation.

If the ovaries are rudimentary, the uterus and other genitalia may be rudimentary or normal.

A. Doran (Trans. Lond. Obst. Soc. XXI. 1879, p. 253) describes a preparation of a foetal uterus with normal tubes in a woman aged thirty-eight years, who had menstruated only once. The ovaries were fairly developed, but contained no Graafian vesicles.

In the absence or marked rudimentary condition of both ovaries the sexual functions are never normal. An affection of one ovary alone does not constitute an obstacle to sexual intercourse or conception.

The diagnosis of absence of the ovaries or supernumerary ovaries, can hardly ever be made with certainty in the living subject, except during the performance of laparotomy. Amenorrh  a, rudimentary development of the other genitals, and the results of exploration may justify a probable diagnosis.

But under favorable circumstances rudimentary ovaries may sometimes be diagnosed with great certainty, as in the following case:

M. B., age thirty-two years, delicately built but appears healthy; is said to have had peritonitis during childhood; never menstruated. An unsuccessful operation for vaginal occlusion had been recently made. Examination shows: breasts slightly developed; likewise the labia majora, minora, and clitoris. Hymen wanting. Immediately behind the external orifice of the urethra, in the same plane of the vulva, is an occluding membrane, with a cicatrix in the middle (from the operation). This forms the bottom of the vulva, and is slightly yielding in the middle.

Bimanual palpation, with two fingers in the rectum, gives the following results: behind the symphysis, in the median line, is a flat, quadrangular organ

with rounded angles, a few millimetres thick, and 2.0 to 2.5 cm. in every direction. It is situated behind the bladder. The right upper angle of this rudimentary uterus passes into a round, smooth, movable cord, which is thicker than the normal Fallopian tube, and runs horizontally outwards for 6 to 7 cm. At its outer extremity, posteriorly, is a small body (rudimentary right ovary), about $1\frac{1}{4}$ cm. long, very thin, very sensitive to pressure, and freely movable. A similar condition is found on the left side, except that the tube is much narrower and the ovary considerably smaller. The patient confessed that she was not free from erotic sensations.

It was possible in this case to feel an ovary as large as a cherry pit and another three times as large, as distinctly as if the organs were situated directly between the fingers.

The diagnosis of the absence or rudimentary condition of the ovaries is practically important from the fact that, when once recognized, all therapeutic measures directed to the production of menstruation must necessarily be abandoned.

CHAPTER III.

CONGENITAL MALPOSITIONS.—HERNIA.

THE ovary sometimes passes through a hernial opening. It has been found most frequently in inguinal hernia (twenty-seven times in thirty-eight cases, Englisch) and generally without any other organ except the Fallopian tube. It is now held that these herniæ are usually congenital. A vaginal process of the peritoneum forms and causes the exit of the ovary, in a manner analogous to the descent of the testicles. In such cases the hernia is not infrequently bi-lateral (twenty-two times among forty-seven congenital cases collected by Puech). It is much more frequent on the left side. When other viscera, such as the intestines and omentum, rarely the uterus, are found in the hernial sac, a suspicion of the secondary protrusion of the ovary is generally justified, and may be explained by adhesion of the ovary to other organs.

The ovary has also been known to pass through the crural canal, sixteen times in seventy-eight cases (Puech), the greater sciatic foramen (Camper, Papen), the umbilicus (Camper), the opening for the vessels in the obturator membrane (Kiwisch and Blazina—perhaps the same case?), or after passing through the deep pelvic fascia, it pushes forward the posterior vaginal walls, and so passes into the vagina or vulva (vaginal ovariocele). With the exception of the latter displacement, the other forms of hernia are so much more difficult of explanation, because the ovary is far removed from the site of hernia. As a result of ovarian hernia, the uterus may assume an oblique position and incline towards the side of the hernia.

All these forms of hernia, except the inguinal, are acquired. The ovary is often found in the hernial sac without the tube. Hence the *alavespertilionis*, and particularly the *fimbria*, must have undergone stretching. The congenital herniæ are almost always irreducible, the acquired ones generally reducible.

Symptoms are entirely absent in some cases. In congenital herniæ, they are often produced at a later period by the natural growth of the organ, which may finally produce incarceration. The pains, which may be present, are said to radiate to the umbilicus, hips and uterine region, and to be increased by lying on the healthy side. Enlargement of the hernial contents and increased pain during menstruation are mentioned

as important symptoms (thirteen times in thirty-eight cases, Englisch). Of great importance is the occurrence of symptoms of incarceration at the period of menstruation or shortly before. Enlargement of the hernia at this time is only significant when determined objectively. Suppuration in the hernial sac or in the ovary itself is not very rare. In five cases the organ underwent cystic degeneration, in one it became cancerous. Sterility is the rule in bilateral hernia, but Beigel reports a case of repeated pregnancy in a woman suffering from double crural ovarian hernia. Whether pregnancy may occur within the hernial sac has not been positively settled by the single case reported by Widerstein.¹

Diagnosis is concerned chiefly with the differentiation of ovarian hernia from other forms of hernia. Inflamed lymphatic glands may also give rise to error, and can only be distinguished by the demonstration of the neck of the sac. The ovary is firmer and tenser than the intestinal contents, but cystic degeneration of the ovary or the Fallopian tube may produce a very similar sensation. Careful bi-manual examination must be made in order to show the connection of the hernial contents with the uterus. Passive movements of the uterus, with the hand or sound, may enable us to recognize traction on the ovary. Obliquity of the uterus towards the side of the hernia, and increase of the tumor during menstruation, would aid the diagnosis. In cases of incarceration the diagnosis has generally not been made (only seven times in twenty cases, Englisch).

The occurrence of uterine malformations in congenital ovarian inguinal hernia merits special mention. Absence of the uterus has been noticed. In other cases the uterus was bicornu, and one horn was situated in the hernial sac.

In Maschka's case the vagina was a solid cord; both horns of the uterus bipartitus were destitute of cavities, the left being situated with the ovary in the left labium major. Leopold describes a similar case of inguinal hysterio-ovariocele, with uterus bicornis. The vagina absent; marked menstrual molimina. A diagnosis of ovarian hernia was made. The horn of the uterus and the ovary were removed by operation at the same time. The ovary (4.5 cm. long, 1.5 cm. thick) presented many cicatrices, follicles and corpora lutea. In Werth's case the vagina formed a short blind sac; the uterus appeared to be absent. Ectopia of both kidneys was recognized per rectum. Both ovaries lay in inguinal herniæ. There were distinct menstrual congestion and swelling of the ovaries; motor and sensory disturbances in the lower limbs. Slow improvement of the motor paresis occurred after the excision of both ovaries.

Klotz describes a case of ovariocele in a true hermaphrodite. An individual aged twenty-four years, with rudimentary penis, had two lateral

elevations on the genitalia; the right one began to grow at the age of sixteen years, and attained twice the size of a man's fist. Violent pains in the tumor were felt every month, and after the eighteenth year were accompanied by a discharge of blood from a fine fistulous opening. Billroth extirpated on the left side a normal testicle, on the right side a cystoid tumor, with tubular gland-like structures which were lined with epithelium and had colloid contents, but did not form well-developed follicles. A Fallopian tube, round ligament, and right-sided uterus unicornis were present.

In not a few cases the ovary in the inguinal canal undergoes degeneration (cystic, cancerous, angio-sarcomatous).

The congenital form of ovarian hernia is attributed to abnormal shortness of the round ligament, but this is rarely demonstrable, and may be a secondary phenomenon. In fact the cause of this condition is unknown.

Acquired ovarian hernia sometimes develops under conditions which are favorable to the development of hernia in general, such as pregnancy and parturition. When the ovarian hernia is associated with uterine hernia, it may be assumed that the ovary has merely followed the uterus, although Cruveilhier thinks it not improbable that the former draws the latter after it.

Treatment is required mainly in cases of incarceration or inflammation and suppuration. Even apart from these processes the pains during menstruation are sometimes considerable. Sterility may also call for therapeutic interference; and, finally, a tendency of the ovary to degenerate is not improbable, so that the hernia can never be regarded as an entirely indifferent matter.

If an abscess forms the pus must be discharged; if the ovary undergoes degeneration, it must be extirpated. The latter operation may be indicated in non-degenerated ovaries, if the symptoms are very annoying and reduction is impossible, as is true in almost all cases of congenital hernia.

As a general thing, if the conditions mentioned are not present, taxis should be tried, and if not immediately successful, prolonged dorsal decubitus and the application of a sand-bag weighing a few kilo, should be resorted to, in order to prepare the way for further attempts at reduction. After reduction a truss must be applied. In a child aged four years, suffering from double inguinal hernia of the ovaries, Rizzoli dilated both canals with the index finger, pushed both ovaries back into the abdominal cavity, and then applied a truss.

If taxis fails and incarceration occurs, the sac must be opened, and according as the organ is adherent or not, we must perform extirpation, or, after dilatation of the neck of the sac, reduction. Rizzoli even separated a totally adherent ovary from a gangrenous loop of intestine in the sac, and replaced it—certainly a procedure which cannot be commended. Rheinstaedter collected thirteen cases of extirpation with eight recoveries.

CHAPTER IV.

DESCENT OF THE OVARIES.

THE ovary also undergoes other displacements, partly dependent on uterine displacements, partly independent.

In marked retroversion of the uterus, the ovary must follow the traction of the short ovarian ligament. Its median end turns backwards, and remains posterior to the lateral extremity, which is fixed by the infundibulo-pelvic ligament. Hence, in retroversion of the uterus, the ovaries remain, as a rule, in front of that organ, and can not be palpated in this position. But in a certain number of cases, one or both ovaries are found behind the retroverted uterus, in more or less close proximity to the vagina. The dislocated ovary usually is not sensitive, and is still movable to a certain extent. Tenderness or immobility is indicative of some complication.

A similar displacement of the ovary when the uterus is in the normal position (prolapsus, better *descensus ovariorum*) is much less readily explained.

According to the degree of descent, the ovary can be felt through the vagina with greater or less ease. In some cases the organ is distinctly enlarged and more or less tender. The latter symptom depends on a complicating neuralgia, or, more frequently, on inflammation of the ovary.

The most frequent subjective symptom is pain in the ovary during or after defecation. In some cases the paroxysm of pain lasts an hour. When these paroxysms occur without previous defecation, they are probably the result of the accumulation of feces in the rectum. The symptom next in frequency is dyspareunia (pain during cohabitation). Some patients also suffer from dysmenorrhœa, and not a few from frequent micturition. In very few cases there is general nervousness, or a neurosis of certain parts of the body. The majority of patients, however, do not suffer from any symptoms, and the displacement is found accidentally.

Etiology.—The puerperal condition undoubtedly plays the chief part in the etiology. Pregnancy is attended with marked displacement of the ovaries, which ascend almost to the level of the umbilicus. This is only possible after elongation of the infundibulo-pelvic ligament. With the rapid diminution in size of the uterus after delivery, this elongation permits the descent of the ovaries. The fixation of the organ by the broad

ligament also becomes lax, when the uterus withdraws from the folds of this ligament, towards the median line of the body. Since the ligaments rarely undergo complete restitution after pregnancy, this condition suffices, in some cases, to produce the displacement. Occasional causes are concerned in other cases—for example, hyperæmic and inflammatory enlargement of the ovary. B. Schultze noticed that an inflamed ovary was displaced downwards, and returned to its old position after the cessation of the inflammation. Mann observed the descent of an ovary after each menstruation. Goodell regards abnormal sexual irritation, which gives rise to protracted congestion of the ovaries, as a frequent cause of their descent.

No cases have been reported in which the disease was produced by violent concussion of the body, but Mundé observed the reappearance of the displacement after violent concussion. Nor has it been established that descent of the ovaries may be produced by increased intra-abdominal pressure from chronic constipation or protracted coughing. This effect is very rarely the result of the pressure of an abdominal tumor.

Finally, displacements of the ovary may be produced by pelvic peritonitis; though not, as a rule, to any marked extent. The ovary is often merely approximated to the uterus, or fixed at its posterior wall, or further down on the broad ligament. But even displacement to the bottom of Douglas's *cul-de-sac* may be produced by retracting exudations.

As a result of the displacement, the ovary may undergo venous congestion and swelling, and become sensitive, and after a long time may become fixed to the bottom of the *cul-de sac* by adhesive peritonitis. The injuries to which it is exposed in its abnormal position favor the development of slow inflammatory processes. On the other hand, it is doubtful whether violent inflammation develops in this way. At all events the oöphoritis or perioöphoritis is then the more important affection.

The diagnosis is based on the recognition of the organ. In addition to the characteristic shape, size and resistance of the ovary, we are aided by the demonstration of the Fallopian tube and its connection with the uterus; finally, by the absence of the ovary from its normal position. The organ is generally palpated most readily through the vagina, sometimes through the rectum. When the ovary cannot be fixed by pressure from above, it may sometimes be palpated with greater facility by pressing it against the sacrum.

Treatment consists in the main of the avoidance of injury, by securing soft evacuations from the bowels, and in many cases by prohibiting intercourse. When the latter condition cannot be secured, the ovary may often be protected by placing beneath it a vaginal pessary. In some cases this device is a source of direct benefit, by bringing the organ nearer to its normal position, and lessening the traction on its ligaments. Thomas's retroversion pessary seems to me to be the most serviceable in

such cases. If there is great sensitiveness, a softer instrument (rubber ring, air pessary) may be employed, and sometimes even this is not tolerated.

In the application of a pessary, care must be taken that the ovary be not wedged in between the instrument and the sacrum, since this is soon followed by violent pains. It may, therefore, be necessary to replace the ovary in the knee-elbow position, and to apply the instrument in this position or in lateral decubitus.

If the uterus is retroverted, its replacement and maintenance in anteversion is generally sufficient to bring the ovary in a sufficiently favorable position.

Complication with oöphoritis and perioöphoritis generally necessitates the treatment of the latter affection. In such cases the question of castration may present itself. Descent of the ovary alone probably never justifies the extirpation of the organ.

In two of Braithwaite's cases, a single ovary was extirpated through the vagina. Violent attacks of dyspnœa constituted the indication in the first case; they ceased almost entirely after extirpation. In the second case the descended left ovary was the site of constant pain; extirpation was attended with complete success. In both cases the ovary was tender on pressure, and probably the seat of chronic inflammation.

In rare cases the ovary also undergoes displacement anteriorly. The ovary, which is displaced above the upper border of the broad ligament, is then situated to the side and in front of the uterus, and upon or near the bladder. The organ is probably always fixed in this position by peritonitic processes. The ovary is generally enlarged. It may be difficult to make a positive diagnosis. Engelmann reports three cases, in one of which the ovary was so close to the inguinal ring as to be regarded as an inguinal hernia. It was not enlarged and was extirpated. The displacement *per se* probably produces symptoms in very few cases.

Beigel reports an unusual case of uterus unicornis dexter, in which the left tube and round ligament extended high up on the psoas muscle, at the edge of which was situated the left ovary.

CHAPTER V.

OVARIAN NEURALGIA.—OVARIE.—OVARALGIA.

OVARIAN neuralgia is a symptom of hysteria. It is situated more frequently on the left side, and occasionally is bilateral. According to Charcot, it is associated very often with anaesthesia of the same side, sometimes with hystero-epileptic attacks. The pain occurs spontaneously in more or less violent attacks, with or without convulsive seizures. It may also be produced by pressure. The patients generally suffer from neuralgic dysmenorrhœa. The dependence of the hystero-epileptic attacks on the affected ovary is shown, according to Charcot, by the effect of pressure on the ovarian region. If the pressure is gradually increased, a more or less fully developed hysterical aura sets in. This begins with pain in the epigastrium, occasionally nausea and vomiting. If the pressure is continued, it is followed by palpitation of the heart, with excessive frequency of the pulse and the globus hystericus. This is followed by cephalic symptoms, loud hissing in the ear on the affected side, pain in the temple, obscuration of vision, particularly on the affected side. Finally, there may be partial or complete loss of consciousness and convulsions.

Vigorous compression may also check a fully developed attack. On account of the great rigidity of the abdominal muscles during the seizure, compression for a number of minutes—the full force of the compressing hand—is often requisite in order to overcome the muscular resistance. After this has been done, the spasmodic symptoms begin to subside, and consciousness returns almost immediately.

Charcot's views have received but little credence from gynecologists, chiefly because it was not proven that the pains are situated in the ovary, and that the compression referred to exercises pressure on the ovary. The latter feature is still doubtful, but this does not affect the nature of the disease and the situation of the pains.

Although not proven by Charcot, many physicians have shown, by means of bimanual palpation, that the ovary is the site of pain in such cases. The patients then stated that the pain produced on palpating the ovary was similar to that experienced in spontaneous neuralgic and hystero-epileptic attacks. Concerning the truth of Charcot's statements, in general, there can be no doubt.

The disease is simply a neuralgia of the spermatic nerves, and belongs to the same category as the migraine, intercostal neuralgia, mastodynia or other visceral neuralgias of hysteria, *i.e.*, it is a symptom of hysteria. In some cases, however, it is an independent neurosis.

The diagnosis can only be made after bi-manual palpation of the ovary, and the demonstration that this organ is the seat of pain. The great resistance of the abdominal muscles may produce difficulty even during narcosis.

If hemi-anæsthesia is also present, or the patient suffers from paralyses, contractures or hystero-epileptic attacks, the diagnosis is certain. But if the neuralgia of the organ is independent, the question of chronic oöphoritis arises. If the history furnishes no data, and if the ovary is not enlarged or its surface altered, the way in which the patient reacts to the examination may be important in diagnosis. In an inflammatory affection, the patient utters cries of pain accompanied by writhing movements of the abdomen, while the pains of ovaralgia are accompanied by irregular convulsions, etc.

The treatment cannot be discussed here. The question of castration will be considered at a later period.

CHAPTER VI.

HYPERÆMIA AND HEMORRHAGE OF THE OVARY.

HYPERÆMIA of the ovaries occurs physiologically during ovulation and sexual intercourse. Its increase may produce pathological conditions, especially chronic inflammations and hemorrhages. The part played by congestion, in producing cystic degeneration, cannot be settled at present. This may also be said with regard to Klob's hypothesis that intense hyperæmia, which leads to apoplexy of the follicles, prevents rupture of the latter, and that the recurrence of these conditions may produce sterility.

Hemorrhage of the ovaries may take place into the follicles or stroma, the former being much more frequent than the latter. Pathological increase of normal menstrual congestion, more rarely at other periods, may produce hemorrhage into one or more follicles, which distends them generally to the size of a hazel-nut, more rarely to that of a walnut. These follicles project, in great part, from the surface of the ovary. The inner surface of the follicle, which is smooth in recent cases, is very thin towards the surface of the ovary; and at a later period not infrequently presents callous thickenings, consisting of connective tissue and granulo-fatty cells.

The blood is generally not firmly coagulated, but becomes thick and converted into granular pigment. After a long time it forms a rusty or chocolate-colored mass, which may attain the consistence of thick honey.

Follicular apoplexy may be the result of blood dissolution and stasis in the abdominal organs. Winckel observed it in heart disease, typhoid fever, phosphorous poisoning, and in three cases of extensive burns.

In the majority of cases the follicle does not rupture, but the ovum is destroyed. Absorption of its contents may lead to complete retraction of the sac and the production of a pigmented cicatrix.

Follicular apoplexy occurs chiefly at a sexually mature age, but occasionally at other periods. It may then be produced by stasis, perhaps by torsion of the organ, and is often seen in cystic ovaries after torsion of the pedicle. In a child a few weeks old, Rokitansky found that the constricted left ovary, with the tube and ovarian ligament, was converted into a sac as large as a hazel-nut, containing a rusty brown clot.

It is not improbable that these hemorrhages may be the cause of cystic degeneration of the ovary. As the result of severe general (puerperal)

diseases, they may be converted, in rare cases, into ichorous foci. If the follicle ruptures, a considerable hemorrhage may occur into the peritoneal cavity, and be followed by peritonitis, rapidly fatal hemorrhage, or retro-uterine hematocele. In Scanzoni's patient (aged eighteen years) the cyst ruptured, and six pounds of blood were found in the peritoneal cavity. The rupture of these sacs is a not infrequent cause of intra-peritoneal hematoceles.

Hemorrhage into the stroma is rarer. It may follow a follicular apoplexy, which ruptures into the stroma, or it may occur primarily as the result of venous stasis or general diseases, which present a tendency to hemorrhage (scurvy, etc.). The hemorrhages vary from little dots of blood to complete infiltration of the entire stroma. A specimen of the latter variety, in which the ovary is nearly spherical and 5 cm. in diameter, is contained in the Halle Museum (Fig. 6). A similar case is mentioned by Virchow, as the result of occlusion of the veins of the ovary.



FIG. 6.—HEMATOMA OF THE RIGHT OVARY AFTER SCURVY. At the same time polypoid hæmatoma of the uterus and left hæmatosalpinx. *O.f.*, left ovary; *C.L.L.*, cyst of the lateral ligament.

In a still-born girl (breech presentation) Schultze found that one ovary was converted into a round tumor $\frac{1}{4}$ th inch in diameter, which was infiltrated throughout with blood, and could be peeled out of the albuginea. Another case is described by Boivin and Dugès. A woman died in a few hours after violent pains in the abdomen and syncope. The abdominal cavity contained three pints of blood. The left ovary was as large as a hen's egg and infiltrated with blood.

As a rule, small hemorrhages disappear by absorption, while large ones may give rise to partial or complete destruction of the parenchyma, the ovary being converted into a cyst filled with a thick smeary mass.

Symptoms are not produced unless rupture occurs, and then they escape notice on account of the coincident severe symptoms of the primary disease or of the rupture. A diagnosis can, therefore, rarely be made. In only one case did I consider myself justified in making a diagnosis. A woman, aged twenty-seven years, was under treatment for profuse menstruation. In the absence of disease of the sexual organs, this was attri-

buted to blood-dissolution, which had given rise to innumerable hemorrhages beneath the skin. After repeated examinations, attended with negative results, I found the right ovary swollen larger than a walnut, and later observed it grow smaller.

In a girl aged eighteen years, Leopold found an ovary as large as a child's fist, which had developed during painful menstruation, and disappeared at the end of eight weeks.

The diagnosis must depend upon the previous history (menstrual disturbances, conditions of blood-dissolution) and the acute development of a moderately large tumor, whose position, spherical shape and mobility, stamp it as the ovary; finally its relatively rapid diminution in size. Extra-peritoneal hematomata of the broad ligament develop under similar symptoms, but are not infrequently larger, are often situated at the base of the ligament, and are immovable. Hemorrhage into a cystic ovary will be discussed at a later period.

CHAPTER VII.

ACUTE OÖPHORITIS AND PERIOÖPHORITIS.

PARENCHYMATOUS (follicular) and interstitial inflammation of the ovaries may be distinguished anatomically. A strict clinical differentiation cannot be made, inasmuch as intense inflammation of the follicles is generally attended with inflammation of the interstitial tissue and *vice versâ*. The inflammation is usually associated with irritation or inflammation of the adjacent peritoneum.

Mild grades of parenchymatous (follicular) inflammation are shown only in the peripheral primordial follicles. The changes are then only microscopical. The contents of the follicles become cloudy and look like pus, and the epithelium is in a condition of cloudy swelling and granular degeneration. The contents of the ovum become cloudy, and the germinal vesicle disappears. In more severe processes all the follicles are affected, and the surrounding stroma takes part in the inflammatory irritation. Clinically demonstrable enlargement of the ovary is not produced by follicular inflammation.

In interstitial oöphoritis the ovary may attain, in a few days double or even four-fold its previous size. In not very severe cases the cut surface is moist and shiny (serous infiltration). The stroma contains numerous young cells, and the stellate connective-tissue cells are increased in number and diminished in size. In more severe grades the cut surface shows a number of yellow, purulent streaks, which start from the hilus. Or the pus is collected in round, poorly circumscribed foci. The tissue is sometimes infiltrated with numerous capillary hemorrhages. In the more severe and acute cases, the cut surface discharges a brown, smeary mass. No structure is recognizable, the organ being converted into a pulp under slight pressure. Whenever the inflammation is violent, it extends to the follicles.

The nature of such conditions admits of no doubt, but in hyperæmic and hemorrhagic conditions, or shrinking of a few follicles, in thickening and cicatricial retractions of the albuginea, it is often impossible to define the boundary between the physiological and the pathological, since ovulation, rupture of the follicles, etc., produce changes which are hardly to be distinguished from inflammatory processes.

Parenchymatous inflammation generally terminates in shrinking and obliteration of the affected follicles. It is probable that thickening of the surrounding stroma and continued increase of the secretion of the membrana granulosa may lead to the formation of cysts.

Interstitial oöphoritis may terminate in very many ways. In severe cases of puerperal inflammation the patient generally dies from the septic process or peritonitis, before the ovarian changes have undergone resolution. In rarer cases an abscess develops, the organ may reach the size of a man's head, and often after a long period the pus discharges in various directions.

In equally rare cases the stroma undergoes gradual hyperplasia, and the follicles are destroyed. The organ may then attain the size of a hen's egg or the fist, and forms a very firm mass (hypertrophy of the ovary). Finally, the connective tissue may undergo retraction, which draws in the surface here and there, and obliterates the follicles, and thus produces a sort of premature involution (granular atrophy or cirrhosis of the ovaries). The ovaries may then diminish to the size of a large hazel-nut. This condition also occurs, physiologically, to a less degree in women who have had numerous children. Klebs attributes this to the hyperplasia of the stroma, which occurs during pregnancy, and which may result in retraction of the parenchyma.

Hyperplasia of the stroma and granular atrophy generally affect both ovaries, abscess only one ovary.

Etiology.—Parenchymatous oöphoritis is by no means rare in acute exanthemata, cholera, relapsing fever, septicæmia, and after poisoning by phosphorus and arsenic. These processes produce changes in the ovary similar to the acute parenchymatous inflammation with rapid destruction of the epithelial elements, produced in the large abdominal viscera. As the process runs its course in these conditions without producing any symptoms, it has no practical significance, unless it gives rise to peritonitic affections, or to obliteration of the entire glandular substance, and thus to sterility. Parenchymatous oöphoritis may be bilateral or unilateral. The left ovary is attacked more frequently than the right, and this fact, together with the more frequent descent of the left ovary, is attributed by Tait to the absence of a valve in the left spermatic vein.

Colds, suppression of the menses, and acute gonorrhœal inflammations of the genital tract are also mentioned as causes of acute oöphoritis. Suppression of the menses must be regarded as a cause, although rare, as is shown by the fact that a few cases of abscess of the ovary have been known to follow this condition. Gonorrhœa produces first, and usually exclusively, a perioöphoritis. Perhaps the parenchyma may be attacked after the perioöphoritis has lasted a long time.

Apart from inflammatory irritation around a few inflamed follicles, interstitial oöphoritis occurs almost exclusively in the puerperal state,

under the influence of the general septic condition, and is almost always bi-lateral.

Perioöphoritis, or inflammation of the peritoneum in the vicinity of the ovary, may occur as an acute, sub-acute or chronic process, and may be primary or secondary to inflammation of the ovary. Adhesions of various extent form upon the surface of the organ. Sometimes there are only a few thin threads or delicate lamellæ, which connect one or both ovaries with the broad ligaments, Fallopian tubes, or peritoneum of the recto-uterine cavity,—more rarely with the uterus or intestines. In other cases the ovaries are enclosed in enormously thick, rigid masses of connective tissue, so that their surface is entirely hidden. In such cases both ovaries are almost always affected and rendered immovable, though, as a rule, not displaced to any considerable extent. Displacement is much more frequent when the fibrous bands are less extensive. The

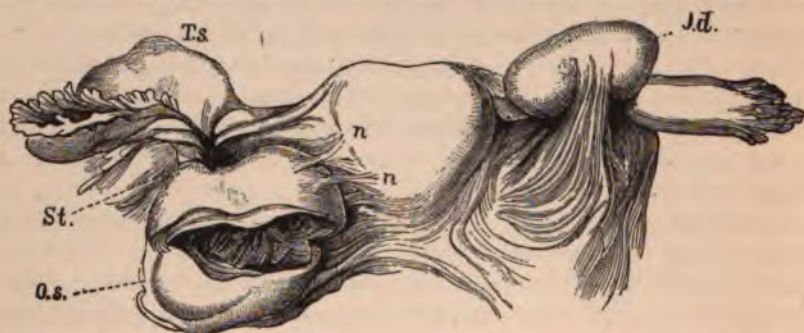


FIG. 7.—PERIOÖPHORITIS AND TORSION OF THE OVARY. *O.d.*, right ovary with broad adhesion to the broad ligament; *O.s.*, left ovary with dermoid cyst (incised); *n.n.*, adhesions to the posterior wall of the uterus; *T.s.*, left Fallopian tube; *St.*, twisted pedicle, containing the ovarian ligament and Fallopian tube.

ovaries are then displaced downwards and backwards, and sometimes reach the bottom of Douglas's *cul-de-sac*.

Next in frequency is displacement inwards, the ovary being approximated to the uterus, and even adherent to it. Displacement outwardly or anteriorly, above the upper border of the broad ligament, is much rarer.

Rokitansky has shown that the traction of such adhesions upon the ovary may cause complete separation of the organ, together with the Fallopian tube and ovarian ligament, and that, if the adhesion has occurred during foetal life or soon after, the growth of the uterus or the pelvis itself may be the factor which gives rise to the traction. This writer also showed that fixation of the ovary at two points may give rise to rotation of the organ around these points, and of torsion of the ligament.

The ovaries beneath thick masses of exudation, are often unusually small and firm, but their surface is generally smooth (simple atrophy from pressure).

The etiology of peri-öophoritis is not identical with that of öophoritis. It is true that violent follicular öophoritis is generally attended with irritation of the surface, which extends to the adjacent peritoneum, but these constitute the less important and violent cases of perioöphoritis. They generally escape diagnosis, and only acquire significance as the result of subsequent adhesions. Interstitial puerperal öophoritis is usually associated with general peritonitis.

Severe perioöphoritis is generally primary, often bilateral, and is usually the result of inflammation conveyed from the tubes (gonorrhœal or acute catarrhal inflammation). The acute inflammations observed after suppression of the menses belong, in part, to this category. But the inflammations conveyed from the tubes are not always very acute. An acute attack is often followed after a prolonged interval by more sub-acute attacks. Repeated relapses of peritonitis, starting from the abdominal orifices of the Fallopian tubes, finally terminate in masses of exudation which enclose the ovaries.

The symptoms differ in no respect from those of other forms of circumscribed peritonitis, and will not be described here.

Non-puerperal follicular öophoritis produces very few or no symptoms. When it accompanies acute febrile general diseases, it runs an entirely latent course. Even in the acute inflammations after suppressio mensium or gonorrhœa, the symptoms are produced mainly by the accompanying perioöphoritis, which is revealed by circumscribed peritonitis at the lateral border of the uterus superiorly. As the ovary is rarely enlarged to any considerable extent in such cases, the diagnosis of acute öophoritis can rarely be made unless an abscess forms at a later period.

Simpson describes a case which was followed by the formation of an abscess. Two days after the beginning of menstruation the patient was seized with violent pains in the right iliac region, and presented evidences of circumscribed peritonitis. On the next day a small sensitive swelling was found above the pubis on the right side, and extended in a few days half way to the umbilicus and to the anterior superior spine of the ilium. The uterus was only slightly movable and inclined towards the right; the vagina was very tender and rigid on the right side and posteriorly. The pain diminished about the fifth day, the meteorism grew less, and the frequency of the pulse diminished. The tumor could now be distinctly circumscribed, and did not extend more than three inches above the symphysis. A fixed pain persisted on the right side of the abdomen and in the right thigh. A certain degree of mobility of the uterus returned about the twelfth day. On the sixteenth day the tumor was hardly perceptible, but was still tender on deep pressure. Vesical symptoms set in and soon afterwards a considerable amount of pus was discharged through the bladder. The patient recovered.

Simpson based the diagnosis of acute öophoritis chiefly on the fact that the tumor corresponded to the region of the right ovary, and that the patient had had four similar attacks. But, as Simpson remarks, an absolutely certain diagnosis can only be made on autopsy.

In West's case the disease began five months after marriage. The

lower part of the abdominal region on the right side soon became swollen; a month later pus was discharged through the bladder, but the tumor was not appreciably diminished. Several months later West found a tumor situated in the median line, which was very tender and fluctuated distinctly. The uterus was not enlarged or fixed, the vaginal walls were not thickened. About seven months after the beginning of the disease pus discharged through the intestines, the tumor diminished quite rapidly, and recovery occurred, after an attack of phlegmasia dolens dextra. The integrity of the uterus and vagina rendered the diagnosis of ovarian abscess probable. Gristock observed a patient who became sick four years after weaning her child. For six months she suffered from diarrhœa, the thin stools being occasionally mixed with blood. Finally, fetid pus appeared. The autopsy showed adhesion of the ovaries, fundus uteri and loops of intestines to one another. The left ovary formed a sac, as large as an orange, filled with pus; this had ruptured into the rectum four inches above the anus.

Lusk found diffuse peritonitis at an autopsy; both ovaries were converted into abscesses, and the outer parts of the tubes dilated and filled with pus. Uterus healthy; the abscess in one ovary had perforated into the peritoneum.

In a few cases in which the disease was bilateral and the Fallopian tubes were also attacked, tuberculosis of the genital tract seems to have played a part in the etiology.

Ovarian abscesses seem to develop occasionally after intra-uterine medication. Kommerell observed a fatal case after curetting in fungous endometritis. The spread of the inflammation-producers from the inner surface of the uterus to the hilus of the ovary must also be assumed in puerperal septicæmia.

The twenty-six cases of acute oöphoritis, reported by Tilt, were probably in great part simple pelvic abscesses. The scanty reports in literature show how rare is the formation of an abscess in non-*puerperal* oöphoritis. Before an abscess has formed the diagnosis of acute oöphoritis can only be made when we are able to palpate the enlarged ovary, and to recognize it as the site of pain. This will be prevented, as a rule, by the accompanying oöphoritis.

Puerperal oöphoritis is much more frequent than the non-*puerperal* form. It is generally secondary, a part-symptom of septic *puerperal* diseases, and its symptoms are masked by those of the diffuse peritonitis, which almost always accompanies it. But in some cases it assumes a more prominent character, and a diagnosis may be made by the often very considerable enlargement of the organ. In much rarer cases *puerperal* oöphoritis develops independently of a general affection. Finally, after the septic process has run its course, the inflammation of the ovary may continue, and may be diagnosed as ovarian abscess.

Disease of the ovaries is a frequent condition in septic puerperal processes (thirteen times in twenty-seven cases observed at Halle). The affection is generally bilateral, but is usually more marked on one side than on the other. Among the thirteen cases mentioned above, the majority were diffuse purulent inflammations or even ichorous destruction of the organ. In one case a large number of Graafian follicles were inflamed, and appeared as small abscesses, lined with a smooth mucous membrane. In four cases large abscesses had developed in the stroma, or the entire organ was converted into a pus sac.

In two cases the enlarged ovary was felt at the side of the uterus. If the tenderness and meteorism permit palpation of the side of the uterus, it will often be possible to recognize an acute inflammation of the ovary during the first part of the puerperal period. The high position of the organ at the side of the non-involuting fundus must be taken into consideration. As a rule, however, such a diagnosis is valueless, on account of the usually rapidly fatal character of the general disease.

Ovarian abscess after puerperal oöphoritis is much more frequent than after the non-puerperal form, although almost all the cases in which the diagnosis was not confirmed by autopsy are very doubtful. Not a small proportion affected previously diseased organs, particularly dermoid cysts, which have a tendency to suppurate, or become gangrenous on account of the compression to which they are subjected during delivery. In rarer cases a previously healthy organ suppurates.

In both events the first symptoms are alike, and consist of acute, more or less extensive peritonitis. After a time the peritonitic symptoms subside, the fever becomes remittent, perhaps almost intermittent, and the patient feels relatively well. At the end of a few weeks, however, the fever with its nocturnal exacerbations reacts upon the general condition. The appetite becomes poor, sleep disturbed, and the pains increase. The tongue is dry and hectic symptoms set in, until the abscess is discharged spontaneously or artificially, or perforation into the peritoneum causes rapid death. In other cases the abscess does not rupture, and the patient dies of exhaustion. According to Kiwisch acute abscess of the ovary may develop without an initial peritonitis. This author has seen cases in which the ovary attained the size of a child's head within two weeks.

In large abscesses the peritonitic and general symptoms become complicated with evidences of pressure upon the pelvic organs. Compression of the iliac vein may give rise to thrombosis with its sequelæ. In a few cases the oöphoritis alternates with parotitis. Bouteillier and Meynet report a case of bilateral parotitis, in a girl æt. sixteen years, after the disappearance of which pain and swelling occurred in one ovary. During convalescence there was a relapse of parotitis and oöphoritis; then recovery ensued without suppuration.

Ovarian abscesses sometimes rupture very early, especially if they have ichorous contents. In a woman who died twenty-four days after confinement I found that the abscess had ruptured into the peritoneum through several large openings. In other cases rupture is delayed for a very long time. While parametritic puerperal abscesses are almost always discharged by the end of the twelfth week, the perforation of ovarian abscesses may be delayed for six months or a year, perhaps even two years. If the abscess is not very large, the pus may thicken into a fatty porridge.

Ovarian abscesses generally attain the size of a hen's egg or fist, in rare cases that of a man's head. Kiwisch describes an abscess which contained sixteen quarts of pus. But it is very doubtful whether such large abscesses are not perioöphoritic in origin. Spontaneous rupture occurs most frequently into the intestines, particularly the sigmoid flexure; not infrequently into the bladder, vagina, and through the abdominal walls.

If rupture does not occur at a very late period, and pure pus is discharged, the abscess cavity generally closes quite rapidly. But if a long time elapses before rupture, the cavity often remains long open on account of rigidity of its walls. This may also happen in suppurating dermoid cysts.

When suppuration or gangrene is long protracted after the abscess opens, the patient may finally die of exhaustion or septicæmia.

The diagnosis is generally not very difficult. The more or less acute development of a tumor with protracted fever, when peritonitis is no longer present, must arouse the suspicion of suppuration. If repeated chills occur and the tenderness returns, and if the tumor becomes elastic or fluctuating, there can be no doubt of the presence of an abscess. The difficulty lies in the differentiation of ovarian abscess from the much more frequent parametritic abscess. The former sometimes possesses a certain degree of mobility, it is circumscribed, and affects adjacent organs, especially the vagina, to a comparatively slight degree. In parametritic abscesses the vaginal walls are usually infiltrated and more or less rigid. Nevertheless, an absolutely certain diagnosis is rarely possible. Whether the suppuration has occurred in a normal or cystic ovary can only be determined if, at the beginning of the disease or previously, we have been able to determine the presence or absence of an enlarged ovary, or if, on opening the tumor, hair, fat or colloid fluid is discharged.

As a rule, treatment consists merely in maintaining the powers of the patient, and in making an artificial opening when rupture threatens. As a rule this can only be done when perforation threatens externally, very rarely when it is about to take place into the vagina or lower part of the rectum. Under certain circumstances the removal of the suppurating organ by laparotomy is indicated.

CHAPTER VIII.

CHRONIC OÖPHORITIS.

UNLIKE acute oöphoritis, the chronic form is better known clinically than anatomically. This circumstance, together with the difficulty of diagnosis, has given rise to diametrically opposite views concerning the frequency of the affection. While G. Veit maintains that we must always identify the clinical with the anatomical standpoint, I believe that chronic oöphoritis is a not infrequent disease, which is clinically well-defined, and can often be recognized with certainty, but concerning whose anatomical relations we know very little. Whether it terminates generally or frequently in granular atrophy of the ovaries, *i.e.*, whether it is an inflammation of this stroma with secondary retraction, cannot be settled at present.

The disease occurs almost exclusively during the period of sexual activity, and is more frequent in married than in unmarried women, particularly during the first years of married life. Excessive sexual intercourse is the most frequent exciting cause; next, chronic inflammation of the endometrium and tubes, which extends to the peritoneum and ovaries. The disease sometimes follows acute oöphoritis. Among twelve of my cases, five had been delivered shortly before the first symptom, and two had suffered from a puerperal peritonitic process. Among 145 patients reported by Fontana, in only 13 per cent. was the disease connected with the puerperal condition. Scanzoni observed the disease frequently after acute inflammations of the adjacent organs, particularly the rectum. Tait thinks that it is sometimes syphilitic in origin, and claims that it often follows acute exanthemata and rheumatic fevers. Duncan regards *suppressio mensium* and gonorrhœa as important etiological factors, and refers to its great frequency in young prostitutes. He often observed it during convalescence from abortions, and after operations on the cervix. This author also regards alcoholic excesses as a frequent cause of the disease, but this cause is not mentioned by other writers. According to Fontana, menstrual disturbances and sexual excitement play an important part in the etiology.

The majority of patients are young (58 per cent. between the ages of twenty and thirty years, according to Fontana). Among 900 gynecologi-

cal cases, in 12 the diagnosis of chronic oöphoritis appeared to be undoubted, and Fontana states that it occurs in 4.75 per cent. of all cases.

The most important and constant symptom is a fixed pain in one or both ovaries. When the pain is violent it radiates towards the sacrum and thigh of the corresponding side. The pain rarely abates entirely, and is increased by exertion, defecation and usually by coitus. There is tenderness on pressure, which may be felt only on firm pressure if the ovary is situated very low, but is sometimes so great that the pressure of the clothing is annoying.

Menstruation is generally disturbed. It is usually excessive, more rarely scanty; it is often irregular. According to Duncan irregular menstruation is, next to the pain, the most important symptom. Menstruation is always attended with pain, except on rare occasions. The pain may be very severe, and usually lasts during the entire menses, but is most acute for the first two or three days. The more scanty the hemorrhage, the more violent the pain. When the flow begins, the pains and other symptoms often disappear. Fontana regards this as the most important feature of chronic oöphoritis, but I do not coincide with him. Kugelmann mentions, as a frequent symptom, a pain which is felt temporarily in one or both hypochondria during the second week after menstruation. Not a few of the patients are sterile, but Duncan observed pregnancy, although both ovaries were affected and considerably enlarged. Neuralgic affections are very common; the dorsal intercostal nerves are often tender on pressure; and the symptoms of spinal irritation are present. Migraine and other neuralgias may be produced. The patients generally feel greatly depressed, but do not manifest the hysterical disposition.

Some patients complain merely of dysmenorrhœa; others rarely pass an hour in which they do not feel ill, and suffer from profound physical and mental depression. They may be rendered absolutely helpless. In very rare cases the symptoms of severe epilepsy and hystero-epilepsy set in.

Examination shows that one or both ovaries are affected. In my experience the disease is generally unilateral, or at least, one side is much more affected than the other. Oöphoritis of one side is sometimes followed by the similar disease on the other side. The affected ovary is always tender on pressure. If its situation is normal, external pressure generally produces more pain than pressure through the vagina. The pain is most severe when the organ is palpated between both hands. The organ is sometimes hard, sometimes soft. Noeggerath recognizes two stages of the disease; in the first, the ovary is soft, enlarged and rounded, in the second it is hard and small. In my opinion the organ is generally tense and enlarged, though the enlargement is partly owing to surrounding exudation. The enlargement is never very considerable (two or three times the normal). In one case Duncan found each ovary as large as a hen's egg, and their inner borders in apposition. These data often re-

main doubtful, on account of the great tenderness of the parts. In not a few cases one or both ovaries have descended, occasionally even beneath the portio vaginalis. Vedeler observed a complication with retroflexio uteri fifteen times in fifty cases. The tenderness is greatest in cases of displacement, and even the slightest contact with the tip of the finger may produce the most violent pain. The uterus is not tender on palpation, but generally is sensitive on passive motion. The surface of the ovary is not infrequently irregular, and studded with nodules. This is more frequent when the ovary is displaced. In such cases there is a more intense complicating perioöphoritis.

The disease is always protracted, and sometimes lasts for years without undergoing material change. In other cases a decided improvement takes place after the lapse of several months.

There is no doubt that, in many instances, some of the symptoms are the result of a chronic circumscribed peritonitis. But we cannot assume a perioöphoritis without a coincident affection of the ovary, because we can hardly conceive of an obstinate circumscribed peritonitis without a primary affection, least of all if the severity of the disease is unchanged for months and years.

The diagnosis cannot be made from the symptoms, situation of the pain, and menstrual anomalies; the ovary must be palpated and recognized as the undoubted site of the pain. Whether the diagnosis can be made with more or less certainty, depends partly on the position of the ovary, partly on the resistance of the abdominal walls, and the other conditions which may interfere with exploration of the ovaries. If their position is approximately normal, bi-manual exploration will furnish the best results. If there is considerable descent of the ovary, rectal exploration, perhaps combined with vaginal exploration, is most serviceable. In unmarried females, the diagnosis is rarely made with certainty, on account of the difficulty of examination; chronic oöphoritis must be distinguished from beginning tumors, perimetritic exudations and ovarian neuralgia. New growths are rarely attended with the fixed pain of oöphoritis, nor is the ovary, as a rule, very tender on pressure. It is larger than in oöphoritis, and is often exquisitely nodular. Perimetritic exudations are characterized by greater hardness and immobility, and by the absence of a round shape. But if they occupy the ovarian region, it will often be impossible to decide whether they depend upon an ovarian tumor or inflammation, or upon disease of the tubes. In acute stages of perioöphoritis, the diagnosis is possible, as a rule, only after prolonged observation.

There is no doubt that many cases of ovarian neuralgia are regarded as chronic oöphoritis. The differential diagnosis is based on the general history of the case, the results of exploration, and the different ways in which the patients react to palpation (*vide* Chap. V.).

In well-marked cases the prognosis is doubtful. Sometimes, however, treatment is followed by decided results at the end of a few months.

The first indication in treatment is the removal of those causes which intensify the symptoms. The most important of these is coitus. Apart from its purely mechanical action, this exercises a directly injurious effect. Vigorous exertion, prolonged standing, etc., should be avoided. During menstruation the patient should occupy the prone position, and constipation should be relieved. The physician should avoid frequent and careless exploration.

Local abstraction of blood from the uterus should always be employed if the pain is severe, but its effects are much less certain than in metritis. Potassium iodide, bromine and gold preparations are the most effective internal remedies. In twenty-five cases Noeggerath always observed a distinct diminution in the size of the tumor in three to eight weeks from the administration of auro-natr. chlor. 0.002 to 0.003 twice a day. In a few cases I have also seen considerable improvement from the use of this remedy, but I am unable to foretell in which cases it will prove useful. Duncan recommends the bichloride of mercury. Narcotics are often indispensable, especially during menstruation.

Vesicants and the application of iodine to the abdominal walls are useful, and the protracted use of foot-baths seems to have been curative in a few cases. A soft, not too large, India rubber ring is a valuable local remedy. It acts by fixing the uterus, and thus the ovary; and in those cases in which coitus cannot be prevented, also acts as a mechanical safeguard. In many cases, especially in considerable descensus ovarii, the softest ring can not be tolerated.

In the severest cases extirpation of the ovary may be indicated. This will be considered in detail in the chapter on castration.

OVARIAN TUMORS.

ANATOMY.

From the histological standpoint ovarian tumors may be divided into those of connective tissue and those of an epithelial character. The first group (dermoid tumors) includes fibromata, sarcomata and myxomata, all of which are rare, particularly the last. The epithelial group includes the frequent cystomata, the rarer carcinomata, and the very rare adenomata.

For practical purposes, however, we classify the tumors as cystic and solid, although both forms of degeneration are not infrequently combined.

Cystic tumors of the ovary include: simple cysts, proliferating cystoma and dermoid cystoma.

CHAPTER IX

SIMPLE CYSTS.

(*Hydrops folliculorum Graafii*.—*Hydrops Ovarii*.)

THE cysts which are formed by dilatation of Graafian follicles do not often present a clinical interest. A number (even ten to twenty) cysts are usually found, but in many cases the ovary does not attain twice its normal dimensions. In some cases the cysts are as large as a fist or man's head, or even as the uterus at an advanced period of pregnancy.

As a rule, only a few cysts undergo any considerable enlargement. The others are almost always very small, and the larger the tumor, the



FIG. 8.—OVARY WITH NUMEROUS DILATED FOLLICLES. (After Leopold.)

more frequently are the small cysts entirely absent; it is then unilocular, even in the anatomical sense.

In those cases in which all the cysts are small, they project in part above the surface of the organ, especially the larger ones, while the very small ones are concealed in its substance. When punctured the cysts discharge usually a light, thin, serous fluid, more rarely a brownish or blood-stained fluid. The cyst-wall is a thin, light gray, partly transparent membrane, which can be separated from the surrounding stroma with so much greater facility the smaller the cyst. This membrane is the

inner part of the wall of a Graafian follicle, and is rich in cells. Internally the cyst contains the cylindrical epithelium of the follicle.

In the somewhat larger cysts, which project above the surface of the ovary, the most prominent part of the wall sometimes becomes extremely thin, so that the ramifications of the vessels may be distinctly seen with the naked eye. Cysts of this kind are sometimes found ruptured and collapsed. The stroma of the ovary is intact, and indeed the majority of the follicles are in a normal condition.

In much rarer cases the ovary is considerably enlarged by cystic degeneration of extremely numerous follicles. The stroma then undergoes gradual destruction, and the enlarged organ consists almost exclusively of numerous cysts which are separated from one another merely by scanty connective tissue.

The first case of this kind was described by Rokitsansky. In a woman, aged twenty-six years, "both ovaries formed a collection of cysts, varying from the size of a cherry to that of a nut, most of which were in close proximity, and here and there were flattened by mutual compression. Some were imbedded in a quite abundant, dense connective tissue. The surface of the tumors was slightly lobulated, and in this region in particular, follicles of the size of a hemp seed to that of a bean were situated between the prominences. The right ovary was as large as a child's head, the left ovary as large as a fist." The contents of many cysts were tinged with blood, greenish or bronze-colored, and contained fatty white blood globules, pigment and fibrinous clots. The small follicles contained an ovulum and remains of the membrana granulosa. The ovulum was opaque, the zona pellucida not well-defined, and the germinal vesicle was almost always absent.

A similar case is described by Lawson Tait, and one which was examined by Ritchie and Webb also appears to belong to this category. Each ovary was as large as the head of a child of four years. There were numerous small cysts, the majority of which contained an ovulum. The walls were partly thickened, and in places secondary cysts had developed.

These cases are distinguished from ordinary dropsy of the Graafian follicles, by the much larger number of degenerated follicles, the majority of which attained a rather considerable size. In addition the disease was bilateral. However, these are merely differences of degree, and do not support Tait's view, that the tumors form a special variety. It is a question, however, whether these cases should not be included among the proliferating cystomata, or whether they do not constitute a transition to the latter.

While ordinary cases of hydrops folliculorum hardly possess any clinical significance, two of the above-mentioned cases rendered bilateral ovariectomy necessary.

Greater practical importance attaches to those cases in which one,

more rarely two or three, cysts develop prominently, while other cysts in the same ovary either do not develop or are atrophied as the result of pressure.

This variety forms quite large tumors, generally not larger than a fist, but in rare cases as large as the uterus at an advanced stage of pregnancy. As a rule, these tumors are strictly unilocular. There are rarely two, three or more cysts, one of which is much larger than the others (oligocystic, paucilocular or multiple cysts). The cysts of such a tumor are merely in juxtaposition, and one never develops from another. The coalescence of several cysts into one by atrophy and rupture of the intervening wall is extremely rare.

The occurrence of tumors of this kind of a size exceeding that of a man's head cannot be doubted. Kiwisch mentions a unilocular tumor whose contents weighed forty pounds. But this is not decisive, since this writer has included proliferating



FIG. 9.—BILATERAL OLIGOCYSTIC TUMOR.

ovarian cystoma with one predominant cyst in the category of hydrops folliculorum. It must also be granted that cysts of the broad ligament were not infrequently regarded, in former times, as dropsical Graafian follicles, and that only anatomical preparations or tumors which are shown, during ovariectomy, to belong undoubtedly to the ovary, are conclusive. Spencer Wells and Peaslee, however, state that the growth of the cysts in question is only limited by the distensibility of the abdominal walls. In 1875 I extirpated an undoubted unilocular ovarian tumor whose contents weighed seventeen pounds. Matthews Duncan possesses a much larger one in his collection.

Proliferating cystomata may also become monolocular by destruction of the walls of the vesicles.

Such tumors cannot always be distinguished from those which begin as single cysts.

Among my last 270 ovariectomies were six monolocular tumors, of which two were degenerated cystomata, and four were simple cysts.

The walls of unilocular tumors vary in thickness, often even in the same tumor. But as a general thing they are thinner and more uniform

than in proliferating cystomata. The wall may be readily divided into two layers corresponding to the tunica fibrosa and propria of the follicle; the albuginea of the ovary may form a third layer. These layers consist of more or less firm connective tissue. The inner surface is always smooth and lined with low cylindrical epithelium.

The cyst contains a thin, usually clear, never stringy serous fluid, with a specific gravity of 1005 to 1020. It contains albuminoids, salts (chiefly sodium chloride), and sometimes cholestearin. Formed elements are very scanty unless hemorrhage or suppuration into the cyst has occurred. If the fluid is clear it contains a very few epithelium cells or none at all; if hemorrhage has occurred the contents of the cyst become darker, bloody, brownish or chocolate-colored.

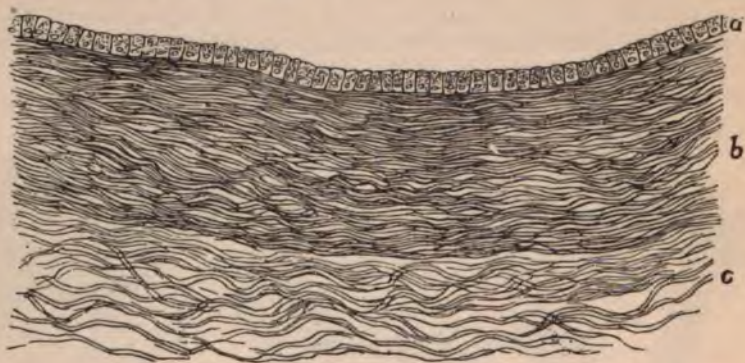


FIG. 10—SECTION OF THE WALL OF A SIMPLE OVARIAN CYST. *a*, Epithelial lining; *b*, dense fibrous layer; *c*, loose fibrous layer.

The following analyses show the chemical constitution of the fluid in detail:

F. Moehring. Large, unilocular tumor, no relapse after a single puncture nine years before. Fluid thin, feebly alkaline, sp. gr. 1014. Constituents: albuminoids 43.75 per cent., sodium chloride, 3.76 per cent., traces of phosphate of lime, carbonate of soda, and fat; no cholestearin or copper-reducing substance.

F. Lincke. Moderately large, unilocular tumor; puncture four years previously, very slight reaccumulation since. Yellow fluid with large masses of cholesterin. Reaction alkaline, sp. gr. 1022. The filtered fluid is perfectly clear, and contains albuminoids (72.4 per cent.) and ash (8.9 per cent.), including cholestearin (1.05 per cent.)

The following analyses are more in accordance with the ordinary findings.

F. Witenbecher. Third puncture, fluid colorless, sp. gr. 1006.8, feebly acid. Solid constituents 10.2 per cent., but organic matters very scanty; very small amount of sugar-producing ferment.

Fourth puncture: neutral reaction, sp. gr. 1007.5; solid constituents 10.7 per cent., very little organic matter; merely traces of albumen; sugar-producing ferment present.

The latter is found not infrequently in ovarian fluids.

If the cysts are small, the ovary is often tolerably intact at their lower surface, *i.e.*, at their point of connection with the broad ligament. It may present well-formed follicles and a normal structure. Its shape is often changed; it is elongated by the pressure and traction of the cysts, and pressed flat. The larger the cysts, the more scanty are the remains of ovarian tissue. Finally, a certain thickening of the wall of the cyst may be the sole indication of the stroma. According to Farre, traces of ovarian parenchyma are found with greatest certainty, if we pass from the fimbriated extremity of the tube, along its longest fimbria to the tumor.

Secondary changes in the walls are rarer than in proliferating cystoma, but are not entirely absent. Fatty degeneration of the epithelium, calcification of parts of the walls, most frequently partial thickenings from adhesions to adjacent organs, have been observed. The vessels of the cyst wall converge towards the pedicle of the tumor, while irregular in other respects.

Genesis and Etiology.—It would be well nigh impossible for us to regard the large cysts as dilated Graafian follicles, were it not for the fact that every possible gradation may be observed between them and the very smallest cysts. In addition the ovula can be detected in the smaller cysts. In the larger ones the ovum is probably destroyed or escapes observation.

Malassez and Sinéty believe that dilatation of a Graafian follicle never produces a cyst larger than a walnut, and they ascribe the large cysts to epithelial new formation from germinal epithelium. They describe the lining epithelium of simple cysts as polymorphous (like that of multilocular cystoma), and are the less inclined to regard it as derived from the cells of the membrana granulosa from the fact that they have often found, in the same ovary, moderate dilatations of the follicles lined with the uniform epithelium of the membrana granulosa, and at the same time large cysts with polymorphous epithelium.

The correctness of these observations cannot be questioned. But the cysts described by these writers as unilocular, are evidently unlike those usually described under this title. Otherwise it would be inconceivable that they found no fewer than twelve simple cysts among fifty ovaries. This is still more true of paucilocular tumors or multiple cysts, which are extremely rare. The opposing views of these writers are explained by the fact that their cases were evidently multilocular cystomata with one or a few large cysts.

Whether the cells of the membrana granulosa always retain their uniform shape or may become transformed, is not known at present. Since

the observations on the transformation of epithelial cells are constantly increasing, and since Zeller has shown that the ciliated epithelium of the uterus not infrequently is converted into pavement epithelium and becomes cornified, the theory that the epithelium of the follicles may change its shape and characteristics loses its improbability.

We must further ask ourselves the question, How is dropsy of the follicles produced? As a general thing the follicle ruptures at its weakest point (the stigma) after a certain increase in its fluid contents. In cyst formation, however, there is not alone an excessive accumulation of fluid, but also an absence of rupture. Hardly anything is known concerning the cause of the latter phenomenon. It is possible that rupture of the follicle is prevented by its deep situation. It is still more probable that this is prevented by thickening of the albuginea or the deposit of peritonitic callosities on the ovary. The former possibility is rendered probable by the fact that the capability of conception generally ceases before the termination of ovulation, because the albuginea has gradually become thicker and firmer. Schroeder has also called attention to the fact that ovaries which are situated beneath peritonitic callosities are not infrequently infiltrated with small cysts.

Another cause of non-rupture may be too slight menstrual congestion which, while it increases the secretion in the follicle, is not sufficiently acute to produce rupture. This agrees with the fact that dilatation of follicles is found with especial frequency in puerperal corpses. The occurrence of these cysts in the new-born is probably explicable in a similar manner. It has previously been said that, according to Sinéty's observations, the parenchyma of the ovary undergoes a certain degree of acute development at birth. It is readily understood, therefore, that, in the absence of menstrual congestion, secretion into the follicles should occur, while rupture does not take place.

According to the views of others the formation of cysts depends on excessive congestion and apoplexy of the follicles. Klob, West, and Klebs have shown that this is probable in some cases, from the fact that the small cysts not infrequently contain fresh blood or brownish, thickish masses, or clumps of pigment and hematoidin crystals. West describes preparations in which some cysts contained pure blood, others more or less blood-stained fluid, and still others purely serous fluid. Cysts of this kind are probably rare and do not attain a large size.

Peaslee regards the disease as a catarrh of the follicles, since it is often associated with intense catarrh of the genital mucous membrane.

Rokitansky has shown that the ruptured follicle, the corpus luteum, may also be the starting-point for the formation of a cyst. He repeatedly found cysts of this kind, as large as a walnut or more, in the periphery of the ovaries of previously pregnant individuals. These cysts presented the following peculiarities: they were lined with a whitish gray layer,

more or less firmly adherent to the cyst-wall, and thicker than the latter. The inner surface of this layer was rough, and was readily recognized as the yellow layer of the corpus luteum, which had been smoothed and thinned by pressure. Rokitansky also noticed that this layer was wanting in one spot, which probably corresponded to the point of rupture of the follicle. These cysts never attain a large size.



FIG. 11.—TUBO-OVARIAN CYST. (After Richard.)

We will here include the tubo-ovarian cysts which were first described by Richard. They are generally unilocular, and of moderate size, the lesser part being furnished by the Fallopian tube, by far the greater part by the ovary. The cyst often reveals the point of adhesion of the two organs by a sharply defined constriction. The tube is dilated along its whole length, or only in its lateral portion, the latter being the more frequent. In rare cases it is convoluted, as in dropsy of the tube. As is shown in Fig. 12, the cyst generally looks on section like a retort.



FIG. 12.—TUBO-OVARIAN CYST ON SECTION.

Richard has observed eleven cases, Rokitansky two cases, the latter in women aged thirty-nine and fifty-seven years respectively. In one case the ovary contained in addition to several small cysts filled with clear serum, a cyst as large as a walnut, whose inner surface was lined with a coarse mesh-work, dotted with a few patches of brown pigment. The terminations of the fimbriae were visible, in part, as small papillae on the inner surface of

the cyst. The lumen of the Fallopian tube was as large as a quill, to within a short distance of the uterus. The other tube was adherent to the atrophic ovary on the same side, but the fimbriæ were free. The other case was similar.

With regard to the genesis of these cysts, Richard assumes that, as a follicle matured, the tube became adherent to the ovary, the follicle first dilated and then ruptured. Rokitansky also assumes a primary communication with the tube, resulting from ovulation and the reception of the ovum by the tube. But G. Veit claims that the adhesion of the tube to the ovary, since it is not a part of physiological ovulation, must have preceded the rupture of the ovarian cyst, and that the formation of tubo-ovarian cysts is best explained by the assumption of a catarrh of the tube and follicle. The tubal catarrh causes circumscribed peritonitis and adhesion of the tube, the catarrh of a follicle causes its dilatation, and its accidental rupture into the tube produces the tubo-ovarian cyst. This theory explains very well the adhesions on both sides in Rokitansky's and Hennig's cases. In the latter a bilateral tubo-ovarian cyst was produced.

According to Burnier, the first stage in the process is adhesion of the fimbriæ, which can occur only on their peritoneal surface. The fimbriæ and their terminations are, therefore, directed inwards. This results in dilatation and dropsy of the tube. If a follicle now matures or forms a serous cyst and ruptures into the tube, the tubo-ovarian cyst is formed. Further secretion of the tube will enlarge the ovarian part of the cyst. This explains the fact that the ends of the fimbriæ are found upon the inner surface of the cyst.

It is very probable that the peritonitis, which causes adhesion of the fimbriæ (especially when bilateral) is often the result of tubal catarrh, *i.e.*, of gonorrhœa.

On account of the increasing dilatation of the ovarian portion of the cyst, the ovary may disappear almost entirely, and persist merely as a thickening of a part of the cyst-wall. In a case of this kind, Burnier found numerous follicles in the wall of the cyst, while internally the cyst was lined with cubical epithelium, the tubal portion with cylindrical epithelium.

It is thus rendered very probable that mature ovula may enter the cyst, and there be fructified. This sheds an entirely new light on the development of ovarian pregnancy.

Indeed Vulliet has recently reported a case of extra-uterine pregnancy, which was shown, on autopsy, to have probably occurred in a præformed tubo-ovarian cyst.

The tube is almost always pervious in the direction towards the uterus, and increased pressure within the cyst occasionally gives rise to discharge of fluid into the uterus. On account of this occasional discharge, the cyst, as a rule, does not attain a large size.

Although in the majority of cases the ovarian portion of the tumor was merely a dilated follicle, *i.e.*, a simple cyst, it is conceivable that the dilated tube may also adhere to one of the cysts of a multilocular ovarian cystoma. In such cases the tumor may be much larger.

The first case of this kind was described by Hildebrandt. The cyst was as large as the uterus at full term, and contained fifteen liters of a grayish-green, thick fluid, large, yellow clumps of fibrin and an abundant amount of cholestearin. The smooth inner surface presented warty excrescences in places. The fimbriated portion of the tube took part in the formation of the cyst, so that the index finger could be passed from the cyst into the tube.

Among 300 ovariectomies I found three cases of tubo-ovarian cysts, one of which was bilateral.

1. Mrs. R., aged twenty-nine years, has had three children, the youngest eight years old. For seven years, severe uterine hemorrhage several times a year. Six months ago, violent attack of peritonitis and confined to bed sixteen weeks. A tumor as large as a fist was found in the pelvis and widely adherent to the uterus. Laparotomy was performed, and I found the tumor situated in a capsule, from which it was removed without hemorrhage. The tube, for 4 to 6 cm. next to the tumor, was greatly dilated but had a natural color, while the cyst wall had a greenish and brownish red color. The left ovary was small, but apparently enclosed in exudation. The outer surface of the tumor was perfectly smooth. The simple cyst contained thick, brownish red masses and grumous clots, which were firmly adherent in part to the inner wall. About 5 cm. of the tube were adherent to the cyst. After opening the latter it was found to consist of two parts communicating by a canal which barely admitted the finger. This canal corresponded to the extremity of the Fallopian tube. From it the fimbriae extended unchanged and free into the ovarian portion of the cyst. The lumen of the Fallopian tube contained a thin, bloody fluid. A second, very narrow opening extended from the lumen of the cyst along the cervical portion to the outer surface. It could be followed externally into a fimbria (*fimbria ovarica?*) which could also be traced for some distance on the inner surface.

2. A woman, aged thirty-four years, childless. The cyst was as large as a fist, and situated in the right side of the pelvis. After extirpation the tumor presented a very irregular shape, but was found to be a simple, thin-walled cyst, with smooth inner surface and thin, serous contents. The tubal portion communicated with the ovarian part by an opening 5 cm. in diameter, while the median portion of the tube was permeable but not dilated. A single fimbria was found on the inner surface of the ovarian portion.

3. M. L., aged twenty-seven years, unmarried. Menstruation frequent and profuse for years. A tumor on the right side of the pelvis was removed and found to be multilocular. The main cyst had fluid, blackish red contents. The entire tumor was covered with peritoneum, and but a comparatively small portion was situated in the broad ligament.

The extirpated tumor, which looked like an ordinary proliferating cystoma, also contained the Fallopian tube, which was dilated and thickened and 53 cm. in length. The median portion, for 28 cm., presents a broad mesosalpinx, while the lateral portion runs for 25 cm. in the wall of the tumor. On being opened the tube discharged a thin blackish-brown fluid, and can be followed laterally into

a cyst of the tumor, as large as a fist. When seen from the cyst, the opening of the tube is markedly convoluted, and the fimbriæ pass over upon the inner surface of the cyst as prolongations of the longitudinal folds.

The left ovary was also found enlarged (hardly the size of a fist) and was also removed. The tumor was a simple cyst, into whose lumen that of the adherent tube entered. The tube was dropsical and sinuous.

The first two cases were simple cysts, the third case occurred in a large proliferating cystoma. In Cases I. and II., the tumors were enucleated from a capsule, but it was doubtful whether this was formed by the broad ligament or by false membranes. In Case I., there had been an acute peritonitis, in Case III. and probably in Case II., a chronic peritonitis. In both patients who had suffered from excessive menstruation, the contents of the cysts were strongly tinged with blood, which was undoubtedly derived from the menstruating tubal mucous membrane. In all three cases the fimbriæ were visible on the inner surface of the cyst, twice running in the mucous membrane of the wall, while in the third case the fimbriated extremities floated free in the lumen.

Burnier also describes a case in which the ends of the fimbriæ were fixed while the middle remained free, so that the finger could be passed between them and the wall.

From the remarks on the cysts produced by dropsy of the follicles, it is evident that a slight grade of this anomaly is not infrequently found in the dead-house, and that it is perhaps the most frequent of all ovarian diseases. They possess a clinical interest only in exceptional cases, when a large tumor is produced.

The clinical history, diagnosis and treatment will be discussed in conjunction with those of proliferating cystoma.

CHAPTER X.

PROLIFERATING CYSTOMA. — COLLOID TUMOR. — MYXOID CYSTOMA. — CYSTOID. — ADENOMA CYLINDRO-CELLULARE. — EPITHELIOMA MUCOIDES.

ANATOMY.

STRUCTURE AND GROWTH.

PROLIFERATING cystoma of the ovary is usually irregularly spherical in shape and of every possible size. The ovary may attain a weight of 50 kilo., *i.e.*, eight times the weight of the uterus at full term. The smaller tumors (less than the size of a man's head) are generally more irregular and firmer than the larger ones. They consist chiefly of small and very small cysts, none of which is much larger than the others. The cysts are filled with thickish contents, and are, therefore, more resistant than in larger tumors. The larger the tumor grows the more certainly does some single cyst attain an unusually large size. This main cyst and other larger cysts have an elastic feel, because they generally have thin fluid contents. Sometimes there are two or three large cysts of approximately equal size, without any main cyst proper. Secondary cysts are commonly found in and on the walls of the larger cysts. These form, in small part, single cysts varying from the size of an apple to that of a fist, but usually they form conglomerates as large as a head, containing innumerable small and very small cysts, and a number of others as large as an apple, or perhaps a fist. In parts in which large cavities are entirely absent, palpation often gives the impression of an absolutely solid tumor. A transverse section of such parts resembles a honeycomb in appearance.

The relation of the individual cysts to one another has been partly described. The smaller ones are always situated in the walls of larger ones; so long as they are very small they may be entirely enclosed in the often thick walls of the large cysts. The larger they become the more they grow above the surface (usually the inner) and finally may be adherent to the mother-cyst by a very small part of their surface. This connection is never pedunculated, nor does the secondary cyst ever separate spontaneously from the primary cyst. But the former sometimes grows to such an extent as to fill the primary cyst completely. This

process may be repeated in the secondary cysts. The juxtaposition of secondary cyst-walls to primary ones may finally produce considerable thickening of the latter.

A more frequent process is the coalescence of several cavities into one. Larger and smaller cysts compress one another, and become flattened. The separating walls undergo compression-atrophy and not infrequently become so thin as to rupture. The opening then dilates rapidly and a cavity then forms, composed of two cysts, and having a biscuit shape. On account of the pressure from within, the narrow neck soon dilates and forms only a circular, more or less projecting ridge. Finally, this ridge may disappear partly or entirely under the pressure of the cystic contents, and thus every trace of the union of the two cysts disappears.

This process is repeated a hundred-fold and thousand-fold. It occurs in the largest as well as the smallest cysts, and diminishes the number of cavities, unless an equal number of new cysts develop. In this way alone are the large cavities produced. After a main cyst has developed, its size is specially increased by the process in question.

The main wall of the tumor generally forms the greatest part of the wall of the main cyst, and is often divided into three layers. In other cases these are reduced to one. When three lamellæ are demonstrable (most frequently near the pedicle), the outer and inner ones are fibrous, while the middle one is composed of loose connective tissue. The latter contains the large arteries, which send their capillaries immediately beneath the epithelium of the inner surface. The veins are very large and muscular, and are situated mainly in the outer lamellæ. Near the pedicle the lymphatics are unusually numerous, of large calibre, and possess an abundance of valves.

Smooth muscular fibres are present, in large numbers, especially near the pedicle and along the course of the vessels. Inasmuch as innumerable secondary cysts develop in the walls of the large main cysts, and as a large number burst internally in their subsequent growth, they serve to enlarge the lumen of the main cyst. If no further cysts of considerable size develop, the originally multilocular cystoma may, in a clinical sense, become unilocular. Indeed, no other cavities may be recognizable with the naked eye, even on cutting through the walls. Usually, however, small cysts are demonstrable with the microscope, and we are justified in the assumption that a tumor which has become unilocular in this manner always possesses the potentiality of developing new cysts, and again becoming multilocular.

The contents of the cavities vary, in the main, according to the size of the cysts. While the largest cavities contain thin serous fluid, even very large ones occasionally possess thick, ropy contents which, however, will flow through a large trocar. The gradual thinning and liquefaction of the contents as the cysts grow larger, are dependent on changes in the

epithelium. Cysts as large as the head, and smaller ones, often contain a honey-like fluid, until finally in the small cysts are found jelly-like masses.

These masses are generally gray and somewhat cloudy, looking like boiled starch; in other cases they have a wine color and look like calves-foot jelly; more rarely they have a greenish tinge. The gray masses are usually extremely tough, so that they may be cut with the scissors, and are removed with difficulty from the alveoli. Under the microscope the gelatinous mass presents a homogeneous structure, except in certain places. If the masses in large cavities are closely observed, white and yellow lines will be noticed, and it will be found that the entire mass consists of columnar divisions, whose long axes run at right angles to the wall of the cyst. These divisions are surrounded by thin layers of the previously mentioned white substance, which consists of degenerated epithelium, drops of fat, granules, and crystals of fat. The genesis of these structures is explained in the following way: the walls of a number of cavities filled with jelly-like colloid substance, undergo atrophy from mutual compression, and the connective tissue is entirely destroyed by absorption. The epithelial elements undergo granular disintegration, but persist for a longer time, and form the white substance around the contents of the individual cysts. The cylindrical shape is owing to the fact that, after the fusion of the individual cysts, their contents have become co ordinate parts of the contents of the common spherical cavity.

In rare cases isolated vessels have been observed free in the gelatinous masses; they must have been left over from the destroyed septa. These vessels may be important with regard to the development of spontaneous hemorrhages in the cystic cavities.

The walls of the individual cysts vary extremely in thickness. Some tumors have very thick walls, others very thin and fragile walls. Chomel reports a case in which the diagnosis of ascites was made, even at the autopsy, because the thin walls were at first overlooked. The outer wall of the entire tumor, which in great part forms the wall of the main cyst, is the thickest and firmest. It consists, like the others, of dense connective tissue, and may be separated into two, often into more lamellæ. The vessels run along the connective tissue of the main wall and the intervening walls.

The greater thickness of the main wall, which does not vary, in the same tumor, between very wide limits, results from various causes. The chief cause is the development, in the main wall, of secondary cysts whose walls, after rupture, help to thicken the main wall. When the tumor forms adhesions to other organs, new callosities are added from without, and these become thicker and thicker on account of the new-formed vessels, which are supplied to the tumor from without.

The inner surface of the cysts is covered with short, cylindrical epithelium. Waldeyer found only one layer, Rindfleisch and others found

several layers. It covers the entire wall and all its projections. According to Malassez and Sinéty, it is extremely polymorphous. They found ciliated epithelium and cup-shaped cells, always in a single layer, and cylindrical epithelium in one or more layers; the deeper layers were often polyhædra. The superficial layers of cylindrical epithelium may be small and flat, or large and high. Very large cells with several nuclei, flattened ones with sinuous edges, and cells with bizarre shapes are also found. The transition between different forms of epithelium may be gradual or sudden. On transverse section of the walls we find numerous depressions of the epithelium, partly cup-shaped, partly cylindrical. They are often arranged in a perfectly regular manner, so that a transverse section of the wall appears very similar to the walls of the stomach. A number of these ampullæ often empty into a common, flat depression of the surface. More rarely they resemble the structure of acinous glands, or form such manifold pictures as to beggar description. The opening of these gland-like structures upon the surface is often remarkably small, and sometimes contains a plug of mucus. Around these structures the stroma is rich in nuclei.

The formation of secondary cysts from the epithelial depressions of primary cysts is now generally recognized. The former must be regarded in part as retention-cysts. They possess a wall of their own only after they have attained a certain size.

The inner surface of the cysts also present prominent vegetations, which are chiefly composed of stroma. The type of these connective tissue formations is generally that of myxoma, more rarely of fibrosarcoma. Their surface is covered with a single layer of epithelium, or the latter has undergone proliferation. Within these structures, which often form dendritic ramifications, epithelial masses often grow from below in a tubular shape, so that the microscopical appearances may simulate those of carcinoma. Small cysts develop occasionally in these epithelial papillæ.

Similar structures develop much more rarely on the outer surface of the wall of the main cyst, but often remain microscopic. As a rule, they have not grown from within, but develop independently on the outer surface.

In the majority of cases the inner surface presents no microscopic vegetations, and these rarely develop to such an extent as to produce a cauliflower appearance, with the exception of a special form of cystoma, which will be considered separately.

Waldeyer applied the term glandular cystoma to those cases in which the inner surface presented very few or no papillary formations, and papillary cystoma to those in which these formations are present. Waldeyer thought that there was no essential difference in the genesis of both forms. It is better, however, to apply the term glandular proliferating

cystoma to all the previously described forms, even if the cavities contain vegetations, and to reserve the term papillary cystoma for a special variety which will be discussed in the next chapter.

The walls of the tumor may undergo the following retrogressive changes:

1. **Calcification.** This is most frequent in the inner layer of the main wall, but a thin layer of connective tissue is generally retained inside of the calcified portion. The calcification consists in the deposit of granules or plates of lime, but not in the formation of psammomatous bodies, as occurs so frequently in papillary cystoma. The calcification may increase greatly when the nutrition of the tumor is suddenly impaired, as in torsion of the pedicle. In Leopold's case, in which the pedicle was twisted six times, the tumor, which was as large as an orange, was almost entirely calcified.

Waldeyer observed a peculiar form of calcification: In one part of the wall of a glandular cystoma were numerous concretions in the immediate vicinity of epithelial cells, and partly enclosed, with heaps of epithelium, in small cavities. In this case Waldeyer assumes calcification of the epithelium or the formation of chalky deposits from the thickened contents of the cyst.

2. **Fatty degeneration** is probably a constant phenomenon in cystomata. The epithelial cells undergo fatty degeneration and are regenerated. The desquamated fatty cells are destroyed, and finally are entirely dissolved. Fatty degeneration also occurs in the connective tissue of the walls, particularly the septa. The fat and cholestearin in the fluids are derived from this process. Whatever impairs the nutrition of the walls must favor fatty degeneration. This is most frequently the result of the pressure of the contents against the septa. These processes have hardly any clinical significance, except that a large amount of fat in the fluids is indicative of slow growth or even standstill of the tumors, at least if they are unilocular in the clinical sense.

3. **Atheromatous processes** occur chiefly in the innermost layers of the inner wall. The epithelium of the affected parts is generally destroyed.

4. **Sinéty and Malassez** have described changes which are perhaps attributable to infarctions. They observed whitish opaque patches, surrounded by a red zone, and always in the septa. The microscope showed a granular mass, with a few fibrillæ of connective tissue, white blood globules and other cells.

CHAPTER XI.

PAPILLARY CYSTOMA (MULTILOCULAR CILIATED EPI- THELIUM CYSTOMA).

THIS tumor was formerly regarded as a mere variety of the ordinary glandular cystoma, but in 1877 I showed that it deserves a separate position genetically and clinically.

The following are the anatomical peculiarities of these tumors. They are generally of moderate size, and never attain the enormous dimensions which are so frequent in glandular cystoma. The cysts contain an often large number of papillary, cauliflower-like tumors which often fill the smaller cysts, and very frequently break through, not alone the walls of the secondary cysts, but also the main wall of the tumor. These perforating papillomata usually extend to adjacent organs, particularly the peritoneum. As a rule, the inner surface of the cysts is lined with ciliated epithelium. The number of cysts is very small. Three-fourths of the tumors are bilateral, and in the large majority of cases their development is extra-peritoneal, most frequently between the folds of the broad ligament. Finally, the fluid contents present certain peculiarities, especially the absence of colloid qualities.

The clinical characteristics of these tumors consist of their much slower growth, the more frequent and early pressure symptoms (on account of their extra-peritoneal position), the frequency of an often considerable ascites, which relapses quickly after puncture, and, finally, the development of metastases, or, more properly speaking, the dissemination of the papillomata over the peritoneum and their growth into other organs.

The anatomical peculiarities will now be discussed somewhat more in detail. On exposing the tumor, the most striking feature is the peritoneal covering, at least in the majority of cases. If the tumor is still situated entirely in the broad ligament, the latter appears distended, and above presents a flattened convexity. The peritoneal covering of the tumor passes imperceptibly into the peritoneum of the iliac fossa and uterus. If the tumor is unilateral the uterus is pushed to the side of the pelvis and generally elevated. In bilateral disease both broad ligaments are distended, and not infrequently fill almost the entire pelvis.

The uterus is then always raised, often to a considerable extent, and is

often entirely hidden by the tumors which are in apposition. The tumor may also develop beneath the peritoneum outside of the broad ligament.

This occurs most frequently towards the rectum. The peritoneum is pushed up from the bottom of Douglas's *cul-de-sac* by the tumor, and this extends between the uterus and rectum, touching both organs directly, after their peritoneal covering has been stripped off. The tumor finally reaches the retro-peritoneal space proper, and may be situated directly on the spine and large vessels, or grow between the folds of the mesentery, generally in the mesentery of the sigmoid flexure. In this manner the tumor often comes into direct contact with the intestinal walls, without the interposition of the peritoneum. In rarer cases the tumor grows anteriorly towards the abdominal walls, and a moderate distension of the broad ligament suffices to bring it in direct contact with the walls of the bladder.



FIG. 13.—BILATERAL OVARIAN PAPILLARY CYSTOMA, EXTIRPATED WITH THE UTERUS. Intra-ligamentary development. n, Papillæ which have perforated the walls.

In the most extreme cases the peritoneum, at the superior strait of the pelvis, passes directly from the spinal column and iliac fossæ to the tumor which fills the pelvis, and it is impossible to pass even the finger into the pelvis, except immediately behind the symphysis.

These statements hold good only with regard to tumors which develop beneath the peritoneum. Under other circumstances the tumor may present the external appearances of a glandular cystoma, and may be pedunculated.

But whether the development has been sub-serous or not, the surface of the tumor may present a peculiar phenomenon, *viz.*, the formation of small tumors which may attain the size of a walnut, rarely that of an apple, and have a distinctly cauliflower-like shape. These are papillomata which, growing from the interior of the cysts, have perforated their walls. They may be connected with the external surface by a broad base or thin pedicle.

These tumors often perforate in other directions, particularly towards the floor of the cysts, and inasmuch as they grow, after perforation, into adjacent tissues, they fasten the tumor to surrounding parts, most frequently to the floor of the pelvis, but also to the uterus, rectum and bladder.

Many of the smaller cysts are entirely filled by papillomata, while the larger ones contain chiefly fluid, although papillomata are also present to an extremely variable extent. The larger the cyst, the more certainly is a large part of the wall smooth and only a small part covered with



FIG. 14.—PAPILLARY CYSTOMA WITH PERFORATING PAPILOMATA. (Preparation from the Museum of the Halle Gynecological Clinic.)

papillomata. These cover the wall as densely aggregated nodules (1 to 2 mm. in height), which give to the surface an almost velvety appearance, or they form branching structures from the size of a pea to that of a nut, situated in part upon pedicles, in part projecting from a broad base into the lumen of the cyst.

The color of the papillary growths varies from pure white to deep red; in some cases they are blackish. They are sometimes hard to the feel, on account of the presence of calcareous concretions. In some places these attain the size of a cherry-pit.

The walls of the cysts consist of firm connective tissue, the outer layers

more fibrillated, the inner layers richer in cells. The epithelial lining of the inner surface is mainly cylindrical, but with great variations. The epithelium is usually cubical in those places which are not covered by papillæ. Seen from the surface they form a regular mosaic, composed of straight, polygonal (usually five or six angles) figures.

The nuclei and nucleoli are quite large. In some parts the cells are



FIG. 15.—MICROSCOPICAL APPEARANCE OF THE PAPILLARY CYSTOMA. (After Coblenz.) *p.v.* Papillary vegetations on the inner wall of the cyst; deeply situated are epithelial tubules, in part in a condition of cystoid change.

provided with ciliæ; indeed, smaller cysts often present only ciliated epithelium.

The villi and papillæ are composed of delicate connective tissue with a few spindle-shaped and round cells. The basement substance often undergoes myxomatous degeneration. The smallest papillæ vary in shape from a simple, button-shaped elevation to the most complete dendritic ramifications, such as are seen in the placenta. The epithelium of the villi is usually much thicker than that on the free inner surface. It is chiefly composed of long cylindrical cells, which are ciliated to a greater or less extent. At the top of the papillæ the epithelium is often cubical;

but large cells of pavement epithelium with an elongated spindle-shape are also observed.

The button-shaped papillæ are poor in vessels, but the ramifying papillæ have a rich supply of vessels, which form an extensive network in the terminal villi.

The papillæ always extend above the surface, and never grow backwards into the stroma of the wall. They develop in the very beginning



FIG. 16.—SECTION THROUGH THE CYST WALL OF A PAPILLARY CYSTOMA. (After Coblentz.)

of the formation of the cysts—perhaps while the latter are still imbedded in the wall of the main cyst—perforate the wall of the cyst which contains them, and thus extend into the cavity of the large cyst. The point of perforation is visible to the naked eye as a circular opening, surrounded by a flat, tendonlike, shining rim.

The calcareous concretions almost always consist of laminated psammomatous bodies; the concentric lamination becomes more distinct when the bodies are decalcified. They are situated mainly in the stroma, less frequently in the papillæ. Very small cysts may be almost entirely filled

with the concretions, and on this account Marchand thinks that they stand in close relation to the epithelial structures. Indeed, they are as constant and characteristic of these tumors as of endothelioma of the cerebral meninges.

Proliferating processes are not prominent in papillary cystoma, but their occurrence cannot be altogether denied. It has been shown that epithelial papules and tubular spaces, lined with cylindrical or ciliated epithelium, are found near the surface of the ovary. In part these communicate directly with the surface of the ovary, the ciliated epi-

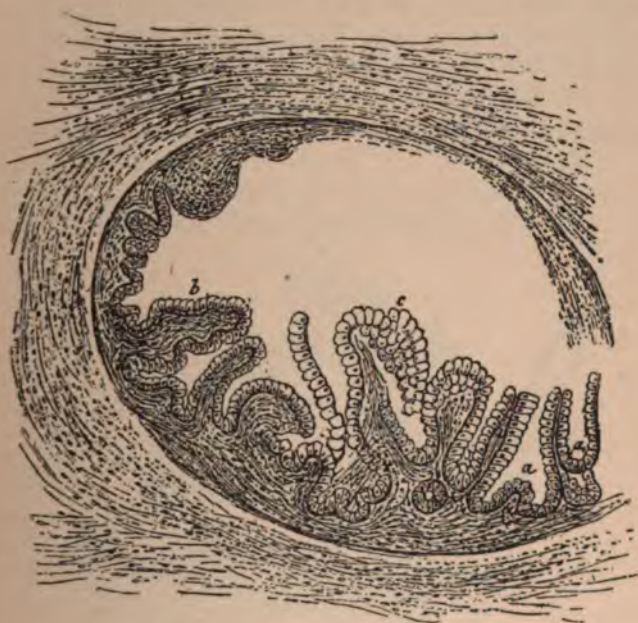


FIG. 17. CYST WITH PAPILLARY PROLIFERATIONS FROM A COMBINED DERMOID OF THE OVARY. (After Fleischlen.)

thelium of the cyst merging directly into the germinal epithelium of the surface of the ovary.

It will be of interest to cast a brief glance at the history of these neoplasms.

Hodgkin undoubtedly saw and described papillary cystomata. Johannes Mueller saw Hodgkin's preparations, described two of them, and included them among cysto-sarcomas.

R. Bright also described an ovarian cyst of this kind, which is contained in Guy's Hospital Museum. Rokitsansky regarded the cases as papillary carcinoma.

Cases have been observed clinically in more recent times by the fol-

lowing writers: Spiegelberg (*Monatsschr. f. Gebk.* XIV., 1859, p. 101), Eaker Brown (*Virch. Arch.* Bd. 45, 1869, p. 103), Hegar (*Volkmann's Klin. Vortraege*, 109, Case II., 1877), John Homans (*Bost. Med. and Surg. J.* April 9, 1874), Marcy (*Ibid.* Sept. 24, 1874), Stilling (*Deutsch. Klinik.* 1869, 26), Koeberlé (*Nouv. dict. de m^{éd.}* 1878, T XXV. p. 509) A. Martin (*Ztschr. f. Gebh. u. Gyn.* VIII. 1882, p. 198), A. Doran (*Trans. Path. Soc.* 1882), Loeblein (*Berl. Klin. Wochschr.* 1879, p. 420), Fischel (*Arch. f. Gyn.* XV. p. 198), Thornton (*Med. Times and Gaz.* 1881, Feb. 19). My own cases will be considered later on.

CHAPTER XII.

PAPILLOMA OF THE OVARY.—SUPERFICIAL PAPILLOMA.

IN rare cases papillary tumors are found upon the surface of the ovaries, which grow there primarily, and have not perforated the walls of cysts. These tumors are solid, but as their structure and development coincide with those of papillomata in cystic ovaries, and they also present similar clinical phenomena (especially abundant, rapidly relapsing ascites), they will be considered here.

The number of reported cases is extremely small. The first preparation is that of Prochaska. Each ovary formed a tumor larger than a fist,



FIG. 18.—SUPERFICIAL PAPILLOMA OF THE OVARY. (After Marchand.)

and looking like a vine-covered tree. The ovaries were intimately united with the dilated tubes.

Mueller assumed that the papillomata originated in cystic cavities, but Marchand justly states that the author makes no mention of cysts.

In Gusserow and Eberth's case the ovaries formed medullary, cauliflower-like tumors as large as a hen's egg. The dendritic villi originated by fine, firm pedicles from a soft, grayish red membrane (0.5 mm. in thickness) which was firmly adherent to the somewhat thickened serous lining of the ovary. Apart from a few dilated and hemorrhagic follicles,

the ovaries on transverse section presented nothing noticeable. Both tubes were dilated and the fimbriæ adherent to the ovaries. The parietal and visceral peritoneum contained slaty discolorations and numerous thickenings. The symptoms began like those of sub-acute peritonitis, and the patient had been tapped three times in eight months.

Birch-Hirschfeld observed a similar case in a girl aged nineteen years. The ramifying villi were covered with several layers of short cylindrical epithelium.

Marchand describes a case in a woman aged sixty-nine years. Both ovaries were very small. In addition to a few very minute growths, the surface of each ovary contains ten to twelve soft, dark red tumors, about the size of a pea to that of a cherry, in a collapsed condition, and connected with the ovary by thin white pedicles. The larger ones contain a solid body, from which spring vascular papillæ, arranged in groups. In the very small tumors the pedicle loses itself in the villi. The tumors are situated mainly on the upper rim, partly on the posterior surface of the ovaries. The free surface of the ovaries is smooth and white. A few follicles and corpora fibrosa are present. The tubes are normal. Not alone were numerous, very small papillæ of a similar structure found in the recto-uterine and vesico-uterine *cul-de-sac*, but the left fimbriæ contained a tumor as large as a bean, and the omentum a number of small ones together with one as large as a fist. The latter, although similar in many respects to the *ovoidomata*, proved to be an undoubted carcinoma.

Another preparation of bilateral papilloma, in a woman aged sixty-six years, is described by Coblenz. The entire surface of the left ovary was covered with papillæ; on the right one they were found in a wreath, corresponding approximately to the boundary of the peritoneal covering. One ovary contained a number of small cysts, the other a cyst as large as a hen's egg. The papillomata took their origin from the surface of the ovary.

The same author describes a second case occurring in my practice. In a woman aged thirty-four years, I removed a proliferating cystoma, which had been changed by torsion of the pedicle. The other ovary was very little enlarged, but presented a branching papilloma, as large as a walnut, situated on a thin, fibrous pedicle.

These are the only cases of superficial papilloma which I have been able to find in the literature of the subject.

The investigations of Marchand and Coblenz show that these superficial papillomata have the same microscopical structure as those which develop in cysts. The epithelium of the surface of the ovary passes directly into the epithelial covering of the villi, but becomes more abundant, especially towards the apices of the villi, where the cubical epithelium also becomes cylindrical. In Marchand's case the epithelium also proliferated

into the stroma of the villi, but the malignant character was not apparent from this feature, but rather from the development of metastases. Coblenz's two cases show with special clearness the close relationship between superficial papillomata and those which have developed in cysts. The ovarian stroma contained, in both cases, epithelial tubules with transitions into cystic cavities, and within the latter, the beginnings of intra-cystic formation of papillomata. In the second case, in addition to the larger papilloma, very small ones were visible on the surface of the ovary. These were situated in round, flat depressions, and had their origin in cysts which were situated immediately beneath the surface and whose external thin wall had yielded to the pressure of the papillomata.

We may hold, therefore, that there is a close genetic relation between both forms of papillomata, but that the superficial epithelium of the ovary evidently presents a very slight tendency to such formations. Why the papillary proliferations should, in individual cases, develop here exclusively or mainly, cannot be decided. But it is not improbable that the irritants which stimulate the germinal epithelium to degeneration, may reach the ovary by way of the tube. Very significant in this regard is the fact that, in two of the above-mentioned cases, both tubes were adherent to the ovaries and had become dropsical—processes which occur most frequently as the result of gonorrhoeal inflammations of the tubes.

CHAPTER XIII.

RARE FORMS OF CYSTIC OVARIAN TUMORS.

GRAPE-SHAPED OVARIAN CYSTOMA.—ENDOTHELIOMA.—ANGIOSARCOMA.
—LYMPHANGIOMA.

A CERTAIN variety of ovarian tumors is characterized by the following peculiarities: a main cyst-wall is wanting. The individual cysts, partly small; partly as large as a fist or more, are loosely connected together, in part are even pedunculated and separated from one another. The walls are extremely thin and transparent, and the contents are thin and watery. This structure gives the entire tumor a great similarity with an hydatid mole.

I have seen only two such cases among about 320 ovariectomies, and know of but one other case, which was observed by Baumgarten. This writer says that the tumor had all the properties of a "true myxoid cystoma of the ovary," except that the cyst body was composed of three separate cysts, connected by pedicles, while generally the main cyst-wall encloses the walls of the smaller secondary cysts.

The following are the histories of my cases:

1. Mrs. P., aged forty-five years, had ten children. For some years menstruation has been unusually infrequent and profuse. The abdomen has been distended for two years; now is as large as at full term. In the recumbent position the belly is unusually broad and distinctly flattened. Distinct fluctuation, more distinct to sight than to palpation. The boundaries of a tumor could not be defined, but a small hard mass was felt in the right hypogastric region. The greater part of the abdomen was tympanitic on percussion. Changes in the percussion boundaries were very distinct on changes in position. A diagnosis of ovarian tumor and ascites was made.

No ascites was found on laparotomy. The extremely thin-walled tumor consisted of transparent cysts, loosely connected together and in part pedunculated; the largest ones were evacuated by puncture. A few were adherent to the vermiform process, pavilion of the tube and broad ligament. The tumor was adherent posteriorly to the broad ligament. On traction a pedicle was formed, which contained neither tube nor ovarian ligament. The ovary on the same side was normal in size, and its uterine connections were normal.

The clear fluid in the cysts contained a large proportion of albumen. Ciliated epithelium was found over a great part of the inner surface of the thin-walled cysts.

The patient recovered and was well when seen two years later.

This case shows very clearly the clinical peculiarities and diagnostic difficulties of such tumors. On account of the thin walls of the tumor its boundaries could not be palpated. This fact, together with the distinct superficial fluctuation and the percussion changes on changes in position, appeared to justify the diagnosis of ascites.

The second case occurred in a woman aged sixty-four years. The tumor was bilateral, and its lower portion on each side was inserted into the broad ligament. The individual cysts had the same structure as in the first case, except that the lining epithelium was cylindrical. Some cysts adhered so loosely to the tumor, that they were removed separately with the tips of the fingers. Both ovaries were lost in the tumors, and could not be found on autopsy. The fluid was somewhat sticky, but thin and alkaline, the specific gravity varied from 1011 to 1014 in different cysts. It contained a large amount of albumin and paralbumin. The cysts did not contain papillomata.

The first case, in which the ovary of the affected side was intact, might lead to the belief that the tumor started from an accessory ovary, and that for this reason a main wall was wanting. In the second case this interpretation is not admissible.

Tumors with proliferation of endothelial elements have been recently described. Leopold first described the following case: in a girl, aged eight years, who died of marasmus, the tumor, which weighed sixteen pounds, contained numerous cavities lined with cylindrical epithelium. The connective tissue had undergone a peculiar change. It contained numerous fine fissures, bounded by fine endothelial sheaths. The endothelium had proliferated in many places into bud-like growths. Many of the fissures were entirely filled by heaps of endothelium, and the walls of the cysts were perforated in many places by proliferation of the connective tissue and endothelium; in places the latter formed onion-like structures within the cysts. Leopold attributes the processes of proliferation in the connective tissue to torsion of the pedicle of the tumor, and believes that the endothelium was derived from the lymphatics. He applies to the tumor the term *lymphangioma cystomatosum*, although it is undoubtedly dependent on epithelial new formation.

Marchand describes purely endothelial tumors. In a patient aged forty-eight years, I extirpated both degenerated ovaries, and also a metastatic tumor, as large as a hazel-nut, situated at the fimbriated extremity of a tube. Two years later the patient was seized with some affection (undoubtedly metastatic) of the spine or spinal cord, and died at the end of six months.

One of the tumors was solid and as large as a fist, the other as large as a head, and consisting in great part of a cyst whose walls (3 cm. in thickness) had the same appearance as the smaller tumor. A transverse

section presented a peculiar laminated structure. The connective-tissue stroma is rich in nuclei, and contains numerous fissures lined with an endothelial membrane. The endothelium has undergone marked proliferation, and forms large accumulations of cells which resemble cancer. The stroma is also proliferated, and in a condition of myxomatous degeneration; many of the cells have undergone hyaline degeneration. Dilatation of the lymph spaces had produced little cysts, and coalescence of these a large cyst.

In Marchand's second case, there was a congenital ovarian inguinal hernia. The tumor, which had gradually grown to the size of $14 \times 10 \times 9$ cm., contained ampullæ lined with endothelial cells. These ampullæ were interlaced with strands of connective tissue, which formed a tunica propria around the cylinders of cells. In parts the connective tissue had undergone hyaline degeneration.

The first tumor was described by the author as cystic papillary endothelioma, the second one as tubular endothelioma (angio-sarcoma).

Noeggerath also holds that some of the cysts in ovarian tumors are endothelial, not epithelial in character, but he ascribes their origin to the blood-vessels, not to the lymphatics. He applies to such tumors the term cystic angioma. One form of cysts is produced, according to Noeggerath, by an endarteritis destruens. The elements of the tunica media undergo hyperplasia, while those of the tunica intima atrophy. Well-formed layers of muscular fibres develop from the media. It is characteristic of these masses that a large number of elongated fissures is produced, each containing a cell. The nearer the centre the larger the fissures become, until they perforate internally and discharge their contents into the pre-existing cysts.

Another case has recently come under my observation. An extremely emaciated girl, of seventeen years, presented an immovable abdominal tumor as large as a man's head, and which possessed the resistance of a parvilocular tumor. The probable diagnosis was cancer of the ovary. An incision through the abdominal walls demonstrated the impossibility of extirpation; nine days later the patient died of exhaustion.

Professor Ackermann made the following report on this case: The tumor consists mainly of a net-work whose shape and arrangement are exactly similar to that of a capillary net-work, and the width of whose individual strands equals that of a capillary. It is also evident from the structure of these strands that they really are capillaries, which are either empty or filled with chiefly round cells. The interspaces are either empty or filled with a homogeneous, probably albuminoid mass, or they contain cellular elements in varying amounts. These cells are partly spindle-shaped (especially near the outer walls of the vessels), partly round.

The tumor, accordingly, was an endothelioma intra-vasculare. The other ovary was normal. The right lobe of the liver contained a tumor (5 cm. wide, 3 cm. deep) which was composed of a loose tissue, resembling a child's brain, and had a firmer zone at the periphery. Secondary changes were also discovered in the retro-peritoneal glands.

CHAPTER XIV.

STOGENESIS OF THE TUMORS.

UNTIL Virchow's investigations on ovarian colloid, this was regarded as identical with dropsy of the Graafian follicles. It was assumed *a priori* that all the cystic formations of the ovary were due to an enlargement of the Graafian follicles. Virchow's separation of dropsy of the follicles from colloid is still held generally.

He first assumed a colloid degeneration of the cells of the stroma. The distending cells and nuclei push the stroma apart, and, by condensation of the connective tissue, form the wall of the first cysts, which become lined with epithelial cells. Virchow then described the growth of the cysts and the enlargement of the cavities by their coalescence. He regarded the large number of cystic spaces as an argument against their possible development from Graafian follicles, but this argument no longer holds good, since their number at the present time is estimated at tens of thousands, or even hundreds of thousands.

Without making an explicit statement to that effect, Virchow places the development of colloid degeneration in the stroma, and ascribes to the epithelial elements no part in the disease. Förster expresses this view more decidedly. 'He says that the connective tissue cells of the stroma collect in groups, that some of them liquefy and separate the tissues, others are converted into epithelium and applied to the wall, thus forming the first cysts.

Rindfleisch and Mayweg also uphold the dermoid origin of certain cystomata. Rindfleisch describes three varieties of cystoid, two of which are said to take their origin from the Graafian follicles. With regard to the third group (myxoid cystoma) Rindfleisch assumes a colloid degeneration of the stroma, but is undecided as to whether there is more frequently a colloid degeneration of the cells and nuclei, or a sort of softening, a colloid liquefaction, independent of the cells. If a cyst, which has formed in this manner, becomes provided with epithelium (this is said to be wanting in very recent structures), the cyst wall begins to secrete and thus increases its contents.

That the stroma itself forms the first cavities is mainly proven, according to Rindfleisch, by the fact that the smallest cavities possess an imperfect or no wall or epithelium, and also by the fact that they contain

a sort of delicate, connective-tissue net-work in their lumen, a phenomenon which is inexplicable if the cysts originated in the Graafian follicles.

Mayweg assumes a double development of colloid tumors. He describes the formation of colloid cysts from connective tissue, and describes a preliminary small-celled infiltration of the connective tissue, *i.e.*, inflammatory irritation, as an important feature. The young cells undergo colloid degeneration, separate the meshes of the stroma, and lead to liquefaction of the formed connective tissue.

According to Mayweg the cysts which develop from Graafian follicles are characterized by an independent wall, and by the fact that they possess an epithelial lining from the beginning.

A number of recent writers, on the other hand, uphold the purely epithelial origin of the cysts. Ritchie and Spencer Wells regard the Graafian follicles as the sole starting-point of the cysts. Harris and Doran entertain the same view with regard to the majority of the tumors. According to these writers, myxomatous and colloid changes occur in unruptured follicles, not in the stroma. But the epithelial origin has been demonstrated most clearly by Klebs and Waldeyer, who assume the following mode of development. The first cysts are formed from Pflüger's tubules by dilatation of their lumen. On their inner surface the epithelium then sinks in many places in the shape of ampullæ, so that these gland-like tubes are at right angles to the surface and open upon a depression of the epithelial lining, either singly or collected in groups. As a rule, these tubes in the walls of the primary cyst run a straight course, but are often dichotomous; they terminate in a blind extremity or communicate with others. Transverse sections of the wall of the cyst present appearances similar to those of the walls of the stomach or intestines. The glandular structures become filled with colloid matter, —the secretion of the epithelial cells,—dilate, become closed towards the cavity of the main cyst, and are thus converted into cysts. The process may repeat itself *ad infinitum* upon the inner surface of these secondary cysts, and thus is formed a proliferating tumor with innumerable cysts. The coalescence of several cysts into one occurs in larger cysts merely from thinning of the intervening walls, which finally leads to perforation. Böttcher also observed another mode of coalescence in very small cysts, *viz.*, by means of canalicular outgrowths of the gland-like ampullæ, and by dilatation of these outgrowths.

According to this theory, the changes occur chiefly in the epithelial elements. But the stroma does not escape implication entirely. In many cases it merely undergoes moderate hyperplasia, forms a cover for the gland-like ampullæ and later for the cysts, and aids in increasing the thickness of the walls of the large cysts. In other cases the hyperplasia of the stroma is also shown, by the formation of button-shaped projections upon the inner wall of the cysts. It is most markedly implicated

in papillomata in which it forms the base of the papillomatous formations.

Klebs and Waldeyer are also agreed that the starting-point of the disease is not an affection of the mature Graafian follicle, but of the egg-tubes. This view is supported by the fact that transitions from Graafian follicles to gland-like tubes have never been found. On the other hand, Waldeyer found in a cystoma, at the boundary of the degeneration, partly isolated groups of epithelial cells in the stroma, partly tube-like structures, in which the cells had been separated by secretion and thus formed



FIG. 19.—EMBRYONAL OVARIAN TISSUE WITH BEGINNING CYST FORMATION. (After *Flaischlen*.)

the beginnings of cysts. But ovula were never found in the epithelial islets or the most primitive cysts.

The origin of the cysts from epithelial tubes is also corroborated by Malassez, Sinéty and Flaischlen. These observers found the beginning of the cysts only in embryonal tissue, but the cysts never contained ovula or epithelium of the membrana granulosa. Testimony to the same effect is also afforded by the fact that the beginnings of the cysts empty directly on the surface of the ovary, so that the often many-shaped, but usually cylindrical, epithelium of the cysts is continued directly into the germ epithelium.

This demonstrates the possibility of the transformation of the germ epithelium into all other forms of epithelium, and it is therefore unneces-

sary to look for a special source of origin for the ciliated epithelium which is sometimes observed in proliferating cystoma.

If one is still inclined to admit the possibility that the mature Graafian follicle may sometimes form the starting-point of proliferating cyst formations, this position may be supported by the hypothesis that, with the destruction of the ovum, the character of the follicle is changed to such an extent that changes in shape and proliferations may take place in the epithelium of the follicle.

The question further arises, at what period of life does the development of cystomata begin. Since the conversion of the egg-tubules into follicles terminates with foetal life, the following alternative alone remains. Either the development of cystomata begins during foetal life, or egg tubules, from which the cysts form, persist in later life, whether in a physiological or pathological manner. Klebs upholds the former view, and supports it by the fact that the formation of ovarian cystomata can very often be demonstrated in early life. Although this cannot be denied, nevertheless it is equally certain that the large majority of cystomata are observed neither in childhood nor at puberty, but at an advanced age, and that there are no anatomical or clinical reasons for attributing their first development to the period of foetal life. Spiegelberg, Langhans and Köster have found egg-tubules in the ovaries of children and adults. Hence the second theory seems to me to be much more plausible, *viz.*, that the egg-tubules which develop late, and, as it appears, at almost all ages, form the starting-point for the growth of the tumor.

The following is a *resumé* of the present doctrines, with regard to the genesis of proliferating cystomata. These tumors are epithelial in character. They probably start from a proliferation of the egg-tubule alone, not of the mature follicles. Proliferation of the epithelium causes depressions in the walls of the primary cysts, which become separated and form secondary cysts. This process of epithelial involution, and a new formation of cysts in the walls of pre-existing cysts, may be continued *ad infinitum*. The mucoid contents of the cysts are the accumulated secretion of the epithelial cells. Further changes are mainly produced by the coalescence of the cysts and the final production of one or more large cavities.

These tumors may be classed, accordingly, among the adenomata, as adenoma cylindro-cellulare. They merely repeat the glandular structure of the ovary. But on account of the formation of large cysts, which does not occur in the majority of adenomata, Waldeyer prefers the term proliferating or myxoid cystoma. Malassez and Sinéty emphasize the epithelial character, and speak of an epithelioma mucoides. The close relations between adenoma and carcinoma also appear in these tumors. The atypical epithelial proliferation which is observed in proliferating cystoma, in still relatively normal ovarian stroma, entirely resembles the first stages of carcinoma, and seems to support the view of those who do

not think that the essence of carcinoma is the mere irregular proliferation of epithelial cells. From a clinical point there are essential differences between proliferating cystoma and carcinoma of the ovary, since the former does not affect the lymphatic glands or produce metastases other than those resulting from local dissemination in the peritoneal cavity. Adenoma and carcinoma are often combined in the same patient.

Papillary cystoma undoubtedly possesses a special genesis. In 1877 I made the suggestion that it started from the parovarium, after Waldeyer had shown that parts of the parovarium regularly enter the hilus of the ovary. The reasons for my opinion were the occurrence of cylindrical epithelium (often widespread) in these cystomata, and the frequency of the intra-ligamentary situation of the tumors. Fischel further developed this view by assuming that the tumors were derived from the granulosa cells, whose origin from the Wolffian bodies he regards as undoubted. He called attention to the observation made by Kölliker on the ovaries of bitches, that strands of cells (so-called medullary strands) pass from the Wolffian bodies into the hilus of the ovary, enter into communication with Pflueger's tubules, and form the cells of the membrana granulosa. Fischel thinks that this also holds good with regard to the human ovary.

But numerous clinical observations have since shown that papillary cystomata must start from the ovary itself, else in small tumors of this character the ovary would occasionally be found together with the tumor. Hitherto Doran has been the only observer who has succeeded in this. But Marchand and Fleischlen have shown that the first beginnings of the cysts, even in these tumors, open directly on the surface of the ovary, and that they may contain ciliated cells, which are directly continuous with the germ epithelium. Marchand also lays stress on the fact that the germ epithelium and that of the tubes are genetically alike, so that it is not surprising that ciliated epithelium should develop occasionally from germ epithelium. The papillary structure also suggests the structure of the tubal mucous membrane, and thus neither the ciliated epithelium nor the papillary products are inexplicable.

According to this view, therefore, the papillary cystoma, like the proliferating cystoma, takes its origin from the germ epithelium, while its further development differs from that of adeno-cystoma.

But this theory leaves much to be explained. We are unable to explain the bilateral occurrence of these tumors or their usually sub-serous location, two features which are rare in proliferating cystoma. Their greater malignity is also surprising, if both forms of tumor are derived from the germ epithelium.

Better understood is the frequent presence of corpora arenacea in the papillary cystomata, inasmuch as the deposit of lime salts may be favored by the different structure of the tumor and the different mode of ramification of the vessels, such as occurs particularly in the papillæ. These

bodies present a certain analogy to the deposits of lime in the fully developed placenta.

The difference in the character of the fluid is owing to the simple fact that the papillary structures secrete a different fluid. On account of the almost entire absence of colloid degeneration and of processes of proliferation, the contents of the cysts do not become gelatinous. The extremely rapid and profuse secretion of the papillæ becomes very striking when they secrete into the free peritoneal cavity. When it occurs into cystic cavities, it is limited by the pressure of the cyst-walls.

We must finally refer to the fact that, in the same way that processes of proliferation occasionally occur to a limited extent in papillary tumors, so also do papillary excrescences develop exceptionally in individual cysts of proliferating cystomata. Not alone may a combination of both processes occur, but these may be associated with carcinomatous and other forms of degeneration.

CHAPTER XV.

THE FLUID OF CYSTOMATA.

THE amount of fluid in ovarian tumors is sometimes enormous. Those which contain thirty to forty pounds, are considered large, but much larger ones have been observed. Even unilocular tumors may contain sixty to seventy pounds or more. Kimball removed 160 pounds during extirpation of a proliferating cystoma, while about twenty pounds remained in that portion of the tumor which could not be removed.

The most varied degrees of difference in the consistence of the fluid may be observed, not alone in different tumors, but even in individual cysts in the same tumor. As a rule, the largest cysts contain the thinnest fluid.

These remarks also hold good with regard to color. There are all possible shades, from colorless or light gray, through every shade of yellow, red and green; the reds generally pass into brown, and in rare cases become almost as black as ink. The dark colors depend on the presence of blood, the coloring matter of the destroyed blood-globules undergoing various transformations. A deep yellow color is due partly to processes of fatty degeneration, partly to admixture of pus. A peculiar greenish shimmer is produced by the presence of cholestearin. This may be present in such amounts as to float about in thick whitish clouds. Thick whitish masses, which resemble boiled starch, are extremely common in the smaller cysts.

We may divide the fluids into those which are thin, almost watery and transparent, those which are serous, usually yellowish or brownish but not ropy, and those which are viscid, always opaque, more or less colored, and present a distinctly mucoid, ropy character. The latter peculiarity is the most characteristic of ovarian fluid, and suffices to distinguish it from ascites.

Watery, thin fluid is found mainly in parovarian cysts, and occasionally in unilocular ovarian cysts; serous fluid is found in the latter, and also in parovarian cysts, into which hemorrhage has occurred, more rarely in obliterated, clinically unilocular proliferating cystomata, or those whose inner surface retains very little epithelium. The viscid and gelatinous masses form the contents of most proliferating cystomata. The fluid of papillary cystomata most resembles the serous fluids, but it

is usually thicker, without being ropy, extremely opaque and of a dirty yellow color.

The specific gravity generally varies from 1010 to 1030 in proliferating cystomata; when they become obliterated it may fall as low as 1006. In exceptional cases the specific gravity is very high (1055 to 1062).

The specific gravity of the fluid of parovarian cysts is usually 1005, but sometimes ranges from 1002 to 1010.

Coagula never form spontaneously in the fluid. But, as a matter of course, fibrinous clots may form in the cysts if a large extravasation of blood takes place. The fluid contents of certain tumors (cysto-sarcoma) coagulate on exposure to the air.

Chemical Character.—The reaction is either neutral or alkaline, the latter being especially marked after warming, when the carbonic acid of the bicarbonates which are present, has escaped. The amount of solid constituents generally varies from 50 to 100 parts per thousand; according to Méhu from 10 to 149 parts per thousand, the variation affecting only the organic constituents (2.5 to 140 per 1000), while the salts were almost constant (7 to 9 per 1000).

Abnormal amounts of solid constituents were observed in a few cases; unusually small amounts are found only in parovarian fluids or hydrops folliculorum. The consistence of the fluids is affected very little by the proportion of solid constituents.

The substances constantly present are proteids, fats and salts. Among the latter Na Cl is the most important, then follow the alkaline and earthy sulphates and phosphates.

Cholestearin is occasionally found (nine times in sixty-one cases, Méhu); the average amount is 10 cgr. in 1 kilo of fluid.

Among other substances which are found inconstantly, are leucin, ammonia, allantoin, cystin and urea (0.5 to 1.54 per 1000). Garrigues claims to have found crystals of indican in one case.

There is great uncertainty with regard to the albuminates and albuminoid substances. Eichwald distinguishes, in the fluids of proliferating cystomata, two series of substances, the mucin and albumin series. The mucin is derived from the changed protoplasm in the cells which have undergone colloid degeneration. It first undergoes a very gradual change into colloid matter, and finally into mucin pepton. The various substances of this series possess very different solubility. While the protoplasm which has undergone colloid degeneration requires diluted alkalies in order to undergo solution, mucin dissolves in the alkaline earths and swells in water. Colloid matter is entirely dissolved in hot water, partly in cold water; mucin pepton is soluble in water with extreme facility.

In the albumin series, true albumin is converted into metalbumin, paralbumin, and finally into albumin pepton. These substances are distinguished from the mucin series by the presence of sulphur and their

precipitation with tannin or neutral metallic salts. The less soluble ones are gradually converted into more soluble ones, and finally change into the readily diffusible peptones, such as are found in the digestive tract, and are derived from albuminates and albuminoid bodies. The cause of this conversion is obscure. Eichwald never found pepsin in the fluids. The younger cysts contained chiefly mucin substances, the older ones albumin substances. He finally comes to the conclusion that, in view of the gradual conversion of the mucin and albumin substances, we may no longer regard the colloid degeneration as dependent on the presence of a specific, chemically definable protein substance.

Hammarsten regards metalbumin as very closely allied to mucin. The chief reactions are the same in both, except that mucin is precipitated by acetic acid, and remains insoluble in an excess of the acid. According to this writer, paralbumin is a combination of metalbumin and albumin.

Waldeyer regards the demonstration of paralbumin, which he always found in the cystomata, as extremely important in differentiation from ascitic fluid. But his statements concerning the positive demonstration are regarded as uncertain, and Huppert claims that the following method of examination is necessary to detect this substance.

1. The fluid is treated with dilute acetic acid and boiled. Experience enables us to add the proper amount of acid, so that after boiling a clear solution is found above the precipitate if no paralbumin is present. If the latter is present, the fluid remains cloudy. Salkowski has since shown that the solution may remain cloudy in simple serous fluids without paralbumin. Very dilute sulphuric acid should be first added, therefore, in order to render it certain that the solution is not alkaline.

2. A precipitate is next formed by the addition of four times the amount of alcohol, and then dissolved in water. If a large part is redissolved in water after standing for a few days, and the solution again presents the reaction described in the preceding paragraph, we may assume the presence of paralbumin. This is distinguished from mucin by the fact that the latter is insoluble in diluted acetic acid.

3. The fluid, which has been treated with a large amount of hydrochloric acid (70 per cent.), is kept for some time in a water bath. The fluid which is filtered off from the precipitate which may have formed, reduces bismuth or copper in alkaline solution, if paralbumin is present. This reaction depends on the decomposition of the paralbumin, a nitrogenous reducing substance being formed.

All these tests require a certain amount of practice in order to warrant a conclusion. Hammarsten's method is very similar: precipitation with acetic acid and boiling, filtration, precipitation of the paralbumin by alcohol, solution of the dried precipitate in water, precipitation of the mucin which may be present, by an excess of acetic acid. The filtrate is

boiled with 5 per cent. of hydrochloric acid, until it becomes brown. After cooling, saturation with an alkali and Frommer's test.

Diagnostic inferences from these chemical examinations must be made with so much more caution, since we are ignorant of the causes of the conversion of albumin into paralbumin, and the latter has been found in various animal organs and substances. Thus, it has been found in the sputum of bronchitis, in a fetal tumor of the sacrum, in a cyst of the neck, in the urine (especially in bone suppuration), and in ascitic fluid (four cases.)

But it is doubtful whether, in the latter cases, the ascites was not the result of the rupture of ovarian cysts, or was mixed with the contents of the latter.

The methods described showed the presence of paralbumin in the large majority of cases, but not in all. Thus, Oerum found it in eighteen cases, while it was absent in five cases.

The quantity of paralbumin is not always directly proportional to the viscosity of the fluid, as might be assumed *à priori*, in accordance with the general opinion that this substance is the main cause of the ropy consistence of the fluid.

Papillary cystomata often contain very little or no paralbumin. Nor did Oerum discover any in two cases of hydrops folliculorum.

We may state, accordingly, that paralbumin is found, apart from ovarian cystomata, in fluids of the abdominal cavity, although very rarely. But it is not constant in ovarian tumors, and occurs almost constantly, though not without exceptions, in proliferating cystomata alone.

According to Waldeyer the liquor folliculi contains paralbumin in solution, and its presence in degenerated ovaries is therefore explained by its physiological occurrence. Oerum denies its presence in the normal follicle and ovary, and regards it as a product of colloid degeneration. Hence it is absent in dropsy of the follicles and in the majority of cases of papillary cystomata. But since the latter are not always purely papillary, but may also manifest colloid degeneration, the occasional presence of paralbumin in these tumors is explained.

The question can only be decided by further investigations.

The following analyses (page 78) illustrates the quantitative relations in a series of cases:

Microscopical Characters.—The following formed elements may be found in the fluids:

1. Epithelial cells. When well-preserved, they are the most important and characteristic elements. They are often fatty, and more or less destroyed.

2. Cells and nuclei in a condition of colloid degeneration. Next to the normal epithelial cells these large, globular, brightly shining bodies are the most frequent and important elements. According to Wells they often split radially from the edges, so that the cell is divided into a

number of sectors. But fluid colloid matter never emerges from these fissures.

Source.	Character of the Cystoma and Fluid.	Protein Substances per 1000	Salts per 1000.	Fats per 1000.	Sugar per 1000.	Urea per 1000.
Eichwald, Case II.	Colloid with three cysts. Fluid thick, tough, yellowish green. Alkaline, sp. gr. 1050.	147.96	9.20	0.99		
Case III.	Unilocular colloid. Fluid thick cloudy, dirty brown. Sp. gr. 1019.	42.37	8.47	0.29		
Personal cases, W., analyzed by Nasse.	Yellowish brown, ropy fluid. Alkaline, sp. gr. 1015.	32.0	8.0			
M., analyzed by Nasse.	Greenish yellow, opalescent, ropy, alkaline, sp. gr. 1019.	42.1	8.6			
Analyzed by Siewert.	Ropy, sp. gr. 1033.	68.76 Fibrin, 0.18. Albumin 68.58.	5.23 4.44 sodium chloride, 0.05 sulphate of soda, 0.74 phosphate of soda.	0	0.32	1.54

3. Finely granular masses, in large part fat and remains of destroyed cells. Not characteristic. This is also true of .

4. Granulo-fatty cells, which are chiefly epithelium in a condition of fatty degeneration.

5. Blood-globules, generally changed in shape, but sometimes normal.

6. Pigment granules and clumps, the remains of hemorrhages. The pigment is sometimes imbedded in the colloid globules.

7. Rhombic tablets of cholestearin.

8. Wandering cells, pus corpuscles, are said not to be present unless the cyst-wall suppurates, but they are found very frequently, though not in large numbers, and often in a condition of fatty degeneration.

9. Villi or parts of villi, which, when present, testify in favor of the diagnosis of papillary cystoma.

Spencer Wells and Eichwald mention cornified cells or flat scales of horny epithelium in rare cases. Drysdale applied the term "ovarian granular cells" to small round non-nucleated cells, which are full of highly refractile bodies. The majority are larger than white blood-globules. They do not change their shape on the addition of ether and acetic acid. Drysdale thinks that they are imperfect epithelial cells of

the cyst-wall, which undergo fatty degeneration, and do not possess a nucleus. They are said to be most frequent in thick-walled, rapidly growing cells. Drysdale regards these cells as pathognomonic, but his views have not been accepted. According to Thornton, they are entirely irrelevant as regards diagnosis. Groups of round or oval cells with many small nuclei (occasionally in vacuoles) are sometimes found.

CHAPTER XVI.

CLINICAL CONSIDERATION OF CYSTOMATA.

ETIOLOGY.

OVARIAN cystomata may develop at any age, though hardly any observations have been reported during foetal life. Doran describes foetal ovaries containing cysts $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter, which were lined with cylindrical epithelium and filled with dendritic vegetations. Winckel also describes the ovaries of a not fully mature foetus, each ovary containing a single cyst with smooth inner surface, and clear serous contents. An important predisposing factor is the age of sexual activity, *i.e.*, the twentieth to fiftieth years. The tumors are much rarer after the age of sixty years, and extremely rare before the period of puberty. Wegscheider reports a bilateral proliferating cystoma, which rapidly attained a weight of two kilo in a girl of twelve years. Marjolin presented a specimen of multilocular cystoma, weighing nineteen pounds, which had been taken from a girl of eleven years. Two cases have been reported at the age of eight and three years respectively. Gaillard Thomas removed a tumor *post-mortem* in a child of three and a half years, in whom the tumor had been detected a month after birth. Several other cases have been reported at an early age.

The following table is collated from cases furnished by various authors:

Under 20 years,	. . . . .	61 cases.
Between 20 to 29 years,	. . . . .	440 "
" 30 to 39 "	. . . . .	499 "
" 40 to 49 "	. . . . .	371 "
Above 50 years,	. . . . .	342 "

This table shows that the disease does not diminish in frequency during the three decennial periods from twenty to fifty years, corresponding to the diminishing number of individuals at that age, but it really increases in the second decennium, from thirty to forty years. This fact is explained by taking into consideration the condition of the patients as regards marriage.

Among 1686 patients 1025 were married, 661 unmarried, thus showing an undoubtedly greater predisposition to the disease among unmarried women.

The following table includes my cases and those of Spencer Wells:

	Unmarried.	Married.
Under 20 years,	43	0
Between 20 to 29 years,	198	96
“ 30 to 39 “	119	217
“ 40 to 49 “	66	216
Above 50 years,	82	208

Now, in Prussia the proportion of unmarried to married women (including widows and divorcées) in the second decennium is 100:78; in the third decennium 100:549; in the fourth decennium 100:786. The increased predisposition of unmarried women is, therefore, very marked.

This fact is best explained on the theory that the cessation of ovulation during pregnancy and lactation, acts as a temporary safeguard against the development of cystomata. We are thus led to the conclusion that menstrual congestion favors the development of the new growths.

This explanation appears to be directly opposed to the statement made by various writers, that pregnancy favors the development of ovarian tumors. Indeed, there are numerous cases in which the presence of a tumor is first noticed immediately or soon after parturition. In many of these cases we learn that the abdomen was unusually large at the beginning of pregnancy, or even during the previous pregnancy.

The unusually frequent discovery of the tumor during the puerperal period is also explained by the fact that the thinness of the abdominal walls at that time is more apt to bring the tumor to the notice of the patient. In addition, parturition, by producing compression of the tumor, gives rise to inflammation of the neoplasm or surrounding parts, and thus furnishes the occasion for an examination.

Boinet states that among 500 women suffering from ovarian tumors, 390 were childless, and Veit states that the statistics furnished by Lee, Scanzoni and West, show 34 per cent. of sterile women. These statements are opposed to those of Negroin, who found among 400 cases (married and unmarried) only forty-three who had not conceived.

Nor does the following table substantiate the statements of Veit and Boinet:

Scanzoni observed 13 childless women among 45 cases.					
Nussbaum	“	1	“	woman	“ 21 “
The author	“	8	“	women	“ 63 “
				<hr/>	
				22	
				129	

Some writers furnish illustrations which point to the possibility of the inheritance of the disease Simpson observed it in three sisters; Rose in two sisters, whose maternal aunt had also suffered from the same disease.

Lever refers to seven fatal cases in one family. I have operated for proliferating cystoma in three pairs of sisters. In all six cases the tumor was unilateral and presented nothing peculiar.

The disease attacks either ovary with approximately equal frequency.

Scanzoni found, from the records of the Wuerzburger Pathological Institute, that among fifty-two patients under fifty years the disease was bilateral thirty-one times (59.6 per cent); in forty-four patients over fifty years it was bilateral seventeen times (38.6 per cent). These statements can only be explained on the supposition that they include the development of small follicular dropsies. Among 1000 ovariectomies Spencer Wells was compelled to extirpate both ovaries eighty-two times (8.2 per cent). In 322 cases I operated forty-four times on both sides, but this large proportion is the result of accident, since among my last forty-five cases, no less than nine were bilateral and papillary tumors. If we bear in mind that the ovary, which has been found healthy on performing ovariectomy, is rarely attacked at a later period, it may be assumed that the proportion of bilateral affections is eight per cent., or at the most ten per cent. Papillary cystomata, however, are bilateral in about seventy-five per cent. of the cases, while in proliferating cystomata the proportion is perhaps not greater than three or four per cent.

Scanzoni states that very many of the patients have suffered from chlorosis during the period of puberty, and regards this as a main element in the development of the disease. According to this writer, among twenty-six patients twenty-one had been chlorotic. Among twenty-two of these cases, fifteen did not menstruate until the age of eighteen years. Scanzoni thinks that the menstrual congestion of the genitalia is diminished in chlorotics on account of the enfeebled action of the heart. As this usually prevents uterine hemorrhage, and, according to Scanzoni's previously mentioned hypothesis, gives rise to thickening of the theca folliculi and then to dilatation, instead of rupture of the follicle, so in like manner it finally produces further disease of the parenchyma. But these views have not been confirmed by other writers.

No other constitutional conditions are known to act as predisposing or direct causes of ovarian cystomata.

CHAPTER XVII.

SYMPTOMATOLOGY.

CLINICAL HISTORY.

THE large majority of ovarian cystomata develop insidiously, and for a long time produce no noteworthy symptoms. It is not unusual to find that the tumor may extend above the umbilicus or even attain the dimensions of the uterus at full term, although the patient does not complain of any symptoms. The tumor is often discovered accidentally if the patient falls or receives a blow, or if she examines herself on account of pain in the abdomen. Or it is discovered accidentally during an examination. But the tumors do not always attain a large size before giving rise to symptoms.

The earliest symptoms consist generally of vesical tenesmus, more or less obstinate constipation, or pain on defecation. More rarely the patients complain of pain in the pelvis, the entire abdomen or the small of the back. Nervous symptoms, such as syncope, are noticed in some cases. Menstruation may be disturbed, though, in the majority of cases, it is not interfered with to any material extent.

As a general thing, the patient does not begin to feel really ill until the tumor is large enough to interfere with the functions of the stomach. When this takes place, the patient is unable to take food freely. Even small quantities produce a feeling of oppression, pressure and fullness in the abdomen. The general nutrition soon suffers in consequence. The patient emaciates and grows weak; sleep is disturbed. The helplessness increases and the patient can no longer find a comfortable position. In many cases there are violent abdominal pains, which sometimes last for weeks, and are produced by partial peritonitides at the surface of the tumor and the abdominal walls. Finally, œdema may develop in one or both legs, and often extends to the vulva and lower part of the abdominal walls. Intercurrent febrile attacks occur, as the result of peritonitis or inflammations within the cysts. Death gradually occurs from exhaustion after months or even years of torture.

In not a few cases symptoms develop even when the tumor is small; these symptoms generally consist of difficulty in defecation and micturition, sometimes of pains deep within the pelvis. When the tumor fills the entire pelvis, a sort of incarceration may occur, similar to that observed in retroversion of the gravid uterus, but usually less acute and

violent. After the usually spontaneous ascent of the tumor, the symptoms may disappear almost entirely, until they are produced anew by inflammation or increased growth of the tumor.

When the tumor is small, symptoms are especially apt to appear if the growth is fixed by adhesions and becomes the cause of repeated attacks of pelvic peritonitis. These cases remind us of others in which the tumor develops very acutely, and immediately after a pelvic peritonitis. The following is the history of a case of this kind:

Mrs. S., aged twenty-five years, healthy appearance: had a difficult labor two years ago, which seems to have been followed by pelvic peritonitis of short duration. Since then has had pains in the abdomen now and then. In January, 1875, patient came under treatment for acute pelvic peritonitis. The uterus was found pushed forward by a tender, elastic tumor which could be felt through the posterior wall of the vagina. The symptoms of the patient—severe pressing, tenesmus of the bladder—indicated an acute development of the tumor. This was regarded as an extravasation of blood, especially as the tense, elastic resistance became firm in a few days and rapidly diminished in size.

The inflammatory symptoms subsided under antiphlogistic treatment, but another peritonitic attack occurred at the end of three months. April 26th, 1875, only traces of the old exudation were found behind and to the left of the retroflexed uterus. In a few days large soft masses of exudation appeared, partly to the left of the uterus, partly behind the cervix.

The retroversion was diminished in a few weeks, and on May 14th the uterus was slightly ante flexed. Very slight exudation still remained in the left parametrium. During May and June there were slight inflammatory symptoms, each time with fresh exudation, at menstrual periods. Then the menses became scanty and no longer produced perimetritis. *Suppressio mensium* from October to January.

It was not until after the fourth relapse of peritonitis (July, 1875) that a tumor was discovered. It was as large as a small fist, extended from the uterus to the pelvic wall, and could be diagnosed as a new growth on account of its spherical shape and elasticity. It seemed to be situated on the posterior aspect of the broad ligament, and there was no doubt, therefore, that we had to deal with an enlarged ovary. In the next month the tumor grew to the size of the head of a new-born child, and the larger part was situated outside of the pelvis. The uterus was pushed forward, and, at the same time, elevated, so that the larger part of the organ could be felt immediately behind the abdominal walls, and above the right Poupert's ligament. In May, 1877, the tumor had attained the dimensions of the uterus in the fifth month of pregnancy. It distended the abdominal walls, presented several distinct divisions, and had all the characteristics of a multilocular cystoma. The tumor moved from the left side to the median line. At a later period, torsion of the pedicle occurred during pregnancy and the tumor became permanently smaller.

It may be doubted whether the four attacks of perimetritis after menstruation were the result of an intra-peritoneal extravasation. The period of onset, the tense elastic consistence of the recent tumor, its subsequent firmness, and the rapid absorption rendered it probable that we had to deal with a hæmatoma. At all events, the acute processes were closely connected with the beginning of the development of the ovarian tumor.

ANALYSIS OF THE SYMPTOMS.

However ill-defined the symptoms of ovarian cystoma may be, the clinical history differs very much in different persons. These differences are produced particularly by certain anatomical changes and by complications. The subjective symptoms may be divided into four groups:

1. *Symptoms produced by the Ovarian Disease as such.*—These are the least important, and consist mainly of menstrual disturbances.

As a general thing, menstruation is not interfered with by an ovarian cystoma, though all forms of disturbance of this function are occasionally met with. The rarest symptom is dysmenorrhœa, and this is hardly ever considerable. Early and excessive hemorrhage is more frequent. In subserous tumors, which develop in the broad ligaments, particularly in the usually bilateral papillary tumors, irregular and excessive menstruation is often an early, important and obstinate symptom. The hemorrhages, in such cases, depend upon compression of the pelvic veins by the tumor. It is found, accordingly, that diminution in the size of the tumor by puncture is a successful remedial agent, while ergotin, intra-uterine injections, etc., prove almost entirely useless. In these tumors the hemorrhages may long precede other symptoms, and may give rise to profound anæmia.

Amenorrhœa is more frequent than menorrhagia. If the disease has produced profound disturbance of general nutrition, amenorrhœa is a very common symptom, and possesses no further significance. This is not true if the general condition is good. We must then think of the possibility of a complicating pregnancy. But if pregnancy can be excluded, the absence of menstruation, the general nutrition being unimpaired, renders it probable that the cystoma is bilateral or that the disease is malignant.

Beigel states that among seventy-six patients, menstruation was normal in forty-nine cases. In thirteen it was irregular, in five profuse, in six scanty; in three amenorrhœa was observed.

But such statistics possess no very great value, because the correctness of the statements depend on the memory and notions of the patient, and because it cannot always be said that the menstrual disturbances are associated with the ovarian disease.

Sterility may be the direct result of the ovarian disease. There is no question that a large ovarian tumor must, as a rule, impair the power of conception partly from interference with the physiological functions, partly from mechanical causes. But conception is not extremely rare, even in very large tumors, and may take place in bilateral tumors. This fact shows that normal tissue may persist for a time, even in profoundly degenerated organs. The tumors may be associated with pigmentation of the mammary areola, more frequently with painful sensa-

tions in the breasts, even enlargement and secretion of milk. These phenomena are not very important, but their occurrence must be recognized in order to avoid a premature diagnosis of pregnancy.

2. *Symptoms dependent on the Pressure of the Tumor.*—These are constant after the tumor has attained a certain size. Even a tumor which is situated entirely within the pelvis may produce tenesmus or strangury by pressure on the neck of the bladder; incontinence or ischuria is much rarer, the duration of the latter being usually very brief. After the tumor has risen out of the pelvis, the upward traction on the bladder and urethra, in the case of large tumors, is as frequent a cause of vesical disturbance as the pressure.

Defecation is impeded by pressure, or it becomes painful if the tumor is sensitive, on account of inflammations on its surface. The vague dragging pains are due in great part to pressure and traction on the abdominal walls and viscera. Distension of the former produces the ruptures in the rete Malpighii, similar to those observed in pregnancy, also dilatation of the veins and oedema of the abdominal walls.

Compression of the stomach and intestines is especially important and annoying. It is only in very rare cases that even enormous tumors are tolerated, perhaps for years, without producing any notable impairment of the general condition. In the majority of cases, the gastric symptoms produced by the pressure of the tumor are the primary cause of emaciation, and the general condition is more impaired by interference with digestion than by all the other factors.

Finally, the diaphragm is pushed upwards, and breathing is rendered difficult. The compression of the lung hereby produced is hardly ever dangerous, but it may threaten life if an acute, complicating affection of the lung sets in.

An important feature is the compression of the renal veins, and in some cases, of the ureters. The former is followed not infrequently by albuminuria, but this is generally not very pronounced. It is important to determine whether it is the result of a mere passive congestion of the kidneys or of more severe disease, a question of importance with regard to proposed extirpation of the tumor.

Compression of the ureters or their flexion, as the result of traction on the bladder, may produce stasis in the pelvis of the kidney, and if bilateral, may cause suppression of urine. Burns and Scanzoni report two cases. The secretion of urine gradually ceased until puncture was made, then it was restored for a time, again ceased, and rendered another paracentesis necessary.

In Scanzoni's case the diameter of the ureters was found, at the autopsy, to be one and a half and two inches.

In a lesser degree the diminution of urine and its rapid, but temporary increase after puncture, are observed not infrequently, but the scanty

diuresis is probably the result, in such cases, of compression of the renal veins. Martin reports a case in which hydronephrosis developed and terminated in fatal uræmia.

The evidences of compression of the large abdominal veins, the formation of hemorrhoids, varices on the legs and marked œdema are comparatively rare in ovarian tumors, when compared with their frequency in pregnancy. A tumor as large as the uterus at full term rarely produces œdema of the legs. Even those which are two or three times as large often produce no trace of œdema, but it is not very infrequent in very large tumors. It is generally bilateral, but often unilateral for a long time. The occurrence of œdema depends mainly on the rapidity of the growth of the tumor. Some cystomata grow so rapidly, at least at times, that their increase in size may be determined from week to week, or even at intervals of a few days. In these rare cases acute œdema often develops in the lower limbs, abdominal walls and back. This may increase so rapidly and be attended with such threatening symptoms as to necessitate rapid interference. Venous stasis often gives rise to ascites, but this generally remains insignificant.

The pressure of the tumor may also produce prolapsus uteri. This is extremely rare as a result of ovarian tumor *per se*, but somewhat more frequent if ascites is also present or the rupture of the tumor suddenly discharges a large amount of fluid into the abdomen.

Umbilical hernia is a much more frequent result of the great pressure. It often develops even in the absence of ascites, and may attain a considerable size.

Zoja¹ reports a unique case in which an ovarian tumor, which was incarcerated in the pelvis, produced an obturator hernia of the bladder.

3. *Symptoms of Complicating Diseases.*—The most frequent and important are the circumscribed peritonitides on the surface of the tumor and adjacent organs, especially the parietal peritoneum of the abdominal walls. Tumors which do not extend above the umbilicus, do not give rise to such inflammations except in rare cases. The larger the tumor the greater the probability of the occurrence of adhesions, and their absence is rare in the very large tumors which extend to the diaphragm. The loss of a portion of the superficial epithelium of a tumor is a necessary condition of its adhesion to adjacent parts. The greater the pressure of the tumor against neighboring organs the more readily will the pressure and friction of the surfaces against one another rub off the epithelium of the tumor and the peritoneal endothelium. This will take place more readily on the anterior surface of the tumor, since the pressure must be considerable at the place where the tumor is permanently applied to the abdominal walls. The adhesions to the abdominal walls are, therefore,

¹ Cbl. f. Gyn. 1877, No. 6, p. 111.

the most frequent and extensive. Next in frequency are omental adhesions, because after the tumor has attained a certain size the omentum is generally situated between it and the abdominal walls. Next come the adhesions to the intestines, bladder, uterus, spleen, stomach, liver, and floor of the pelvis. In the large majority of cases the adhesive inflammations which result in parietal adhesions, run an apyrexial and latent course.

In other cases they are attended with pains which last for days or weeks. Tenderness of the affected parts may render the diagnosis possible, and this may be confirmed by a subsequent friction murmur. Adhesions to the omentum and floor of the pelvis also run a latent course in many cases. Extensive intestinal adhesions are almost always the result of more violent peritonitis, such as follows torsion of the pedicle or rupture. Violent and extensive inflammation is rare, apart from these two causes.

Much rarer than peritonitic affections are marked disturbances of the intestinal tract. The obstruction may give rise to intestinal irritation and temporary diarrhoea, but as a rule this subsides spontaneously in a short time. A very rare effect is the occurrence of intestinal occlusion, even progressing to ileus. This is most apt to occur when loops of intestines have become adherent to the tumor, and, therefore, particularly after torsion of the pedicle. A woman aged fifty-five years, had three attacks of peritonitis in five months, and then came to the clinic with symptoms of ileus. Laparotomy showed an ovarian tumor of moderate size, with torsion of the pedicle; loops of intestine were adherent to the tumor, and one of them was flexed in such a way as to be impervious. The patient died on the second day with symptoms of intestinal paralysis.

In other cases the tumor occludes the lower part of the rectum by compression. Intestinal occlusion is also observed occasionally after puncture from twisting of the intestines, if the latter have been adherent.

The most unfavorable cases are those in which the occlusion is the result of the enclosure of a loop of intestine by the masses of a malignant tumor.

A not uncommon sympathetic symptom is the production of the secretion of milk, and has been often observed even in young girls.

4. *Symptoms on the Part of the General Condition of the Patient.*—This generally remains good until digestion is materially disturbed by pressure on the stomach. Then marasmus gradually develops. The appetite is lost, the tongue becomes dry. Sometimes there is persistent vomiting, which leads to inanition. The tumor becomes more prominent as the body emaciates, and the patients, with their sunken features, glassy expression of the face, and enormously distended abdomen, present the most harrowing picture of misery and helplessness.

But such cases have almost disappeared with the progress of ovariectomy.

For the present we will pass by the objective symptoms of ovarian cystomata, and consider certain clinically important changes in the tumors.

1. HEMORRHAGES IN THE CYSTS.

These are not uncommon, and are due to various causes. When papillomata form within the cysts, spontaneous hemorrhages may occur from the wide superficial vessels of the papillæ. The blood may also come from the wall of the cyst, if the increasing dilatation has ruptured a vein. But the most frequent cause of considerable spontaneous hemorrhage is torsion of the pedicle.

Finally, intra-cystic hemorrhages may occur after puncture. They depend on sudden diminution of pressure in the cyst, which causes rupture of the capillaries. In exceptional cases the puncture may injure a large vessel in the wall of the cyst.

As the hemorrhages, as a rule, take place slowly and in moderate quantities, they generally run a latent course and possess no prognostic significance.

In a few cases, however, the hemorrhage is so large as to threaten life, and it is sometimes so acute in torsion of the pedicle, or after puncture, that an approximately positive diagnosis is possible. Parry¹ reports a case in which the hemorrhage into the cysts was so sudden and violent as to produce dangerous collapse. The diameter of the cyst was enlarged one to one and a half inch in every direction within a few hours. Rosenberger² reports a similar case. The hemorrhage threatened the patient's life; its source was not discovered on performing ovariectomy. The wall of the tumor was thick but brittle, and was extensively adherent. The patient recovered.

2. SUPPURATION AND GANGRENE OF THE CYSTS.

Suppuration or gangrene of one or more cysts almost always follows puncture, and is rarely spontaneous. The use of unclean instruments or imperfect disinfection introduces substances which excite suppuration or gangrene.

Spontaneous suppuration or gangrene is extremely rare in simple cysts, proliferating and papillary cystomata. I have no doubt that, in such cases, the gangrene is generally, if not always, the result of the immigration of decomposition-producing organisms from the intestines. I have previously shown that this is the probable explanation of the gangrene of puerperal pelvic exudations. As a general thing, we find extensive and intimate adhesion of several loops of intestines--adhesions such as almost

¹ Amer. Journ. of Obs. Nov. 1871.

² Berl. Klin. Wschr. 1880, p. 271.

always occur after torsion of the pedicle. The same cause plays a great part in simple suppuration. Weil¹ mentions a case, however, in which there were no intestinal adhesions, and puncture had not been performed. He assumes, therefore, the introduction of fermentative substances from the blood. But so long as this case remains unique, we must bear in mind the possibility that intestinal adhesions were present, but were loosened unnoticed during the ovariectomy.

Suppuration is observed not infrequently after parturition, when the tumor in the pelvis has been subjected to great compression. Dermoid cysts, but not proliferating cystomata, generally undergo suppuration under such circumstances. It is questionable whether the compression does not merely favor the development of suppuration.

Suppuration or gangrene is attended with more or less acute and high fever, which may be preceded by a chill, and soon assumes the hectic type. The morning temperature is normal or slightly elevated, the evening temperature exceeds 39°, 40°, or even more. If the fever is protracted it may be attended by all the ordinary sequelæ of suppurative fever. The body emaciates and the patient dies of marasmus, unless the purulent focus is removed. It must be kept in mind that suppuration or gangrene of the cysts produces no pain unless complicated by peritonitis.

When the abscess persists for a very long time, a period of apyrexia may set in, if the walls become so thick that pus is no longer absorbed. It is only in extremely rare cases, however, that, as Chadwick reports, no fever occurs at all.

3. TORSION OF THE PEDICLE.

Torsion of the pedicle is a not infrequent, very important process, which is usually susceptible of diagnosis. Among fifty-eight autopsies on cases of ovarian tumor, Rokitsky found torsion of the pedicle eight times. Spencer Wells observed it twelve times in 500 ovariectomies, and has no doubt that he overlooked it in other cases. I observed it twenty-one times among 322 ovariectomies, Schroeder twenty-seven times among 194 ovariectomies, Thornton thirty-four times among 400 ovariectomies, and Howitz thirteen times among only fifty-six operations. It probably occurs in about 8 per cent. of all cases.

In torsion the enlarged ovary turns on its pedicle either internally (towards the uterus) or externally. At the same time it may turn on a frontal axis, anteriorly or posteriorly, or the torsion may occur chiefly in the latter direction. The torsion always affects the ovarian ligament and the portion of the broad ligament which is included in the pedicle. The tube generally takes part in the process, and then surrounds the other portions of the pedicle in a spiral manner. In a few cases it is isolated

¹ Prag. med. Wschr. 1878, 43.

and does not become twisted. The round ligament is very rarely involved. The torsion generally consists of half a turn to two turns, but five and six turns have also been observed.

The causes of this condition are not entirely clear. Many attribute it to the peristaltic movements of the intestines, but it is questionable whether this force is sufficient except in the case of very small tumors. The most frequent cause is undoubtedly the unequal growth of the tumor itself. If this grows chiefly in one direction, on account of the predominant growth of a single cyst, the tumor may topple over and make a half turn; this process may be repeated and the torsion become more complete or it may be restored. Nor is it improbable that tumors which are situated entirely within the pelvis, are occasionally impeded posteriorly by the resistance of the promontory, and, therefore, move out of the pelvis in a rotary manner. In other cases the causal factors are changes in the position of the body, especially on sudden or abdominal pressure in lifting, or perhaps during defecation. Torsion also occurs occasionally after an examination, if the tumor has been moved to and fro to a considerable extent. I produced torsion of a dermoid, which was remarkably movable, during an examination under an anæsthetic. This was followed by an acute, circumscribed peritonitis, which rapidly produced fixation. Or a tumor (such as the pregnant uterus) growing next to the ovarian tumor, conveys a rotary movement to the latter. Barnes reports two fatal cases of this kind, and others have been observed.

A still more potent factor is the emptying of the uterine contents during delivery.

Puncture of the tumor may act in a similar manner.

Except in rare cases considerable size of the tumor will prevent torsion of the pedicle. Breisky and Stansbury report torsion of very large tumors, but the latter case occurred in a parturient woman. Broad adhesions to the abdominal walls, or, in small tumors, to the floor of the pelvis, render torsion impossible. But this is not always true of slighter, band-like adhesions. Rokitansky has called attention to the fact that the adhesions are sometimes primary, and then present torsion in an opposite direction to that of the pedicle. But instances of these primary adhesions (usually at the lateral extremity of the ovary) undoubtedly are very rare.

A potent predisposing cause of torsion is the presence of a considerable amount of ascitic fluid, although this also makes the restoration of a torsion possible. But the chief factor is the character of the pedicle. A long round pedicle favors torsion, as is shown by numerous instances. Fränkel reports an interesting case in which a prolapse of the uterus evidently produced elongation of the pedicle, and thus became the cause of torsion.

Dermoid cysts present torsion of the pedicle with unusual frequency; among my cases four occurred in tumors of this kind. Others have been reported by Rokitansky, Fränkel, Kœberlé, Dumreicher and Thorn-

ton. Very few cases have been reported of torsion of the pedicle in solid tumors. In Van Buren's case the tumor was a fibroma as large as a fist, in Klob's case as large as a child's head. Leopold reports torsion of a sixteen pound cysto-sarcoma in a girl of eight years. Veit and Dannien have also reported cases. It may be assumed *à priori* that the broad, short pedicle of the majority of solid tumors offers an unconquerable obstacle to torsion.

Basing his views on a small number of cases, Tait arrives at the conclusion that the right ovary presents a much greater tendency to torsion than the left. I may state, however, that fifteen of my last nineteen cases of torsion occurred in tumors of the left ovary.

Torsion on both sides has been observed by J. Veit, Röhrig and Thornton.

The sequelæ and symptoms of torsion of the pedicle depend in great part upon the intensity and acuteness with which the torsion sets in. The anatomical changes undergone by the tumor are dependent on the circulatory disturbances. The most frequent form of interference with the circulation consists in compression of the veins of the pedicle. The venous stasis gives rise to hemorrhages into the cysts, cyst-walls and the pedicle itself. The hemorrhage into the cysts may be very considerable and produce intense anæmia and even death. Spencer Wells reports two fatal cases. In one the cyst contained five pounds of blood; in the other the tumor had ruptured and discharged its contents into the abdominal cavity. Patruban has also observed fatal hemorrhage from torsion of the pedicle. The stasis and intra-cystic hemorrhage sometimes cause an acute, diagnostically important enlargement of the tumor. Œdema of the pedicle, or, in solid tumors, of the entire growth may also set in. In cystomata the main wall of the tumors assumes a dirty gray or liver color. This discoloration depends less on extravasation into the wall than upon imbibition of the bloody contents of the tensely distended cysts.

After the torsion has lasted for a long time, the veins of the pedicle become thrombosed, and its size is doubled or trebled, as the result of the torsion, œdema and extravasation. After a time the pedicle often becomes so brittle that it crumbles under the pressure of the fingers, and is at once divided on the application of a ligature. In not a few cases the tumor is entirely separated from the uterus by division of the pedicle. In a large majority of the cases, however, the tumor has undergone such extensive adhesions to the omentum, mesentery, intestines or other organs, that its further growth is better supplied than before.

Complete separation of dermoid cysts has been observed with special frequency. It is probable that the majority or all of the dermoid cysts which are found in the abdominal cavity, unconnected with the uterus, have started in the ovary. Baumgarten and Hofmeier have noticed complete separation of such

tumors. Many operators have observed cases in which the very adherent tumor had no normal connections with the uterus.

Those preparations are also interesting in which the pedicle has not been completely separated. Rokitsky and Lunnitzer have described cases in which the tube was twisted until it was as thin as twine. Very interesting and obscure are those cases in which the unenlarged, even the infantile ovary, has been found completely separated. Fränkel found the left ovary of a girl aged one year, infiltrated with hemorrhages, and lying as a loose body in Douglas's *cul-de-sac*.

But long before such marked changes occur in the pedicle, the arteries must have been narrowed by the torsion. The necessary results are retrogressive changes in the tumor, extensive fatty degenerations and calcifications, which may lead to more or less rapid diminution in the size of the tumor. Under favorable circumstances this may remain permanent. This was noticed in the case described on page 84. The tumor, which was as large as the uterus in the sixth month of pregnancy, has diminished (six years after torsion) to the size of a child's head, and has remained stationary for some years. Other cases of considerable diminution in size or calcification are reported by Veit, Hofmeier and Flaischlen. Breisky¹ reports a very interesting case. The tumor extended to half way between the umbilicus and ensiform cartilage. After an attack of violent pain, lasting several hours, the tumor first increased in size, but soon began to grow smaller. Nine months after the painful seizure the tumor was as large as a child's head, five to six years later only as large as a hen's egg. The pedunculation of the tumor on the uterus had been demonstrated. Such retracted cystomata generally contain a brownish, smeary, fatty mass.

Cases of permanent diminution form a sort of spontaneous recovery, but they are rare exceptions. The peritonitis accompanying torsion of the pedicle is usually followed by extensive, not infrequently by general, adhesions of the tumor, anteriorly to the abdominal walls, posteriorly to the omentum and loops of intestines. Indeed, it may be said that almost all extensive adhesions to the intestines are produced by torsion of the pedicle. As a result of these adhesions the tumor receives an abundance of new vessels, which may supply the growth of the tumor even better than did those of the pedicle. Another frequent and very serious sequel of the usually very intimate intestinal adhesions is gangrene of the contents of the cysts. It is highly improbable, however, that this, or even mere sup-puration, may result directly from torsion of the pedicle.

Among the most grave, and at the same time rarest results of torsion, is occlusion of the intestines. This may happen if the tumor is adherent to the intestine, and thus conveys the torsion to the latter, or if the pedicle passes around a part of the gut. In Guenther's case, the occlusion was produced in another manner. As a result of the torsion of the pedi-

¹ Wien. med. Pr. XXIII., 1882, p. 601.

cle and its consequent shortening, the tumor was pressed so firmly against the superior strait of the pelvis, that the rectum was rendered impervious at the entrance to the pelvis on account of the compression.

Knowsley Thornton has called attention to a peculiar phenomenon prior to the occurrence of torsion of the pedicle.

In a girl aged twenty-four years he observed, six months before torsion, violent pains which began two days before menstruation. These occurred with less violence previous to the subsequent menstrual periods, and then torsion of the pedicle developed, with acute symphysis. I have observed a similar case. The patient, aged thirty-eight years, suffered from extremely violent pains two days before menstruation, and was compelled to take to bed. At the end of the menstrual period the pains diminished, but did not disappear entirely. A month later she was again attacked by violent pains, accompanied by fever and severe vomiting. Although the pains grew less severe, the patient was permanently confined to bed. Every movement produced an exacerbation of the pain. The patient was greatly emaciated on account of profuse diarrhœa and night sweats. In this condition the operation was performed. The tumor, which had grown rapidly of late, proved to be a proliferating cystoma, weighing 10 kilo., with numerous adhesions; the pedicle was twisted once. The patient recovered.

I suspect that in both of these cases the first pains occurred at the time of the torsion of the pedicle, the latter being favored perhaps by the menstrual congestion. We can readily understand that the latter condition should again produce pain after torsion has occurred. It might also be asked whether the torsion did not occur temporarily during the first attacks of pain, then disappeared, and later developed permanently. I have no doubt, from my experience in two cases, that torsion of the pedicle may disappear. In a woman aged fifty-four years, all the signs of previous torsion of the pedicle were found on ovariectomy: greenish color of the cyst-wall and pedicle, brittleness of the latter, and thrombosis of its vessels, bloody contents of the monolocular tumor, adhesions to the abdominal walls, but the pedicle was not twisted. The second case was similar.

Torsion of the pedicle is attended with numerous and grave dangers. The patient may die from intra-cystic hemorrhage. More frequently death is the result of acute diffuse peritonitis. In some cases this takes place so rapidly, that the question arises whether the processes of decomposition in the tumor after torsion of the pedicle do not produce a sort of poisoning, not septic, which threatens life. Finally thrombosis of the vessels of the pedicle may endanger life, probably even after extirpation, by giving rise to pulmonary embolism.

If the patients survive the immediate dangers of torsion, they often run down as regards the general condition, complain constantly of severe

pain, are confined to bed, and suffer from ascites. The complexion occasionally becomes yellowish, and leads to the suspicion of serious cachexia, especially of cancer. Finally the patient may die of marasmus as the result of the suppuration or gangrene.

As a rule, the diagnosis is not very difficult. Every attack of severe diffuse peritonitis renders the diagnosis of torsion very probable. Rupture of cystomata alone hardly ever produces violent peritonitis; this may happen in rupture of dermoid cysts, but these cysts hardly ever rupture spontaneously. If an examination has been made prior to the onset of the peritonitis, and especially if the tumor was found to be very movable, this only increases the suspicion of torsion of the pedicle. If the peritonitis is soon followed by increased size and tension of the tumor, the diagnosis becomes so much more certain. This is also true if the tumor subsequently diminishes in size. Finally the diagnosis will be facilitated by acute anæmia of the patient, the entrance of fluid into the abdomen, and the subsequent development of marasmus with persistent pains. In some cases it might be possible to feel the torsion through the vagina or rectum, although no diagnosis has hitherto been made, to my knowledge, in this manner.

If the diagnosis is probable, and the symptoms threatening, the treatment consists of rapid extirpation. The treatment would be the same, even if rupture of the cyst were mistaken for torsion. Wiltshire was the first to operate during the collapse produced by torsion. In such cases, however, the operation presents less favorable prospects than in other cases. The decomposition of the cystic contents favors sepsis. In one case Schroeder observed death from sepsis on the seventeenth day after the operation. Thornton lost a patient, who was in the fourth month of pregnancy, sixteen hours after ovariectomy, although abortion did not result. An operation long after the occurrence of torsion is rendered unusually difficult by the extensive and vascular adhesions to the intestines.

In twenty-two positive cases among 322 of my ovariectomies there are two or three, occurring years ago, in which the diagnosis of torsion was subsequently rendered probable from the absence of the pedicle, the general adhesion of the tumor, the bloody contents of the cysts, etc. Four cases occurred in dermoid cysts, one in a tubo-ovarian cyst, the rest in proliferating cystomata. Fourteen cases were preceded by severe peritonitis, partly in repeated attacks of long duration. In twelve cases there were extensive, in part very intimate, adhesions to the intestines. In several cases the pedicle was unusually long and round. Two patients were very anæmic at the time of operation, although no blood had been lost except that extravasated into the tumor. In three cases all symptoms of stasis and sequelæ of torsion were absent; in the majority of cases one or half a twist had produced all the symptoms.

The following *post-mortem* appearances have been described. Ribbentropp found one pound of brownish opaque serum in the abdominal cavity; in front of

the last lumbar vertebra were two viscera of a deep, bluish black color. One was the sigmoid flexure, the other the right ovary, which was as large as a placenta. The ovarian and round ligaments were elongated, and formed a strand as thick as the finger and two to three inches in length. The right ovary contained a cavity as large as a child's head, in which was a small amount of fluid similar to that in the abdomen. The ovarian tissue was bluish red and infiltrated with blood. The intestines presented two stenoses. The ovary and its ligament had turned once around the intestine like a screw, so that it was again on the right side, the intestine in question on the left side.

Röhrig's case is still more interesting. In the recto-uterine fossa lay the right ovary as a cystic tumor, 8 cm. long and 5 cm. broad, which presented a deep annular constriction. It consisted of two cysts, the larger one a dermoid cyst. A spirally twisted strand, 3 cm. long, connects the ovary with the uterus. It consists of the twisted broad ligament around which is twined the right tube. The left ovary is an irregular round tumor as large as a walnut, with a firm, chalky, nodular surface; this cyst contains a yellow pulp with a large amount of cholesterolin; no hairs. This ovary is divided in front of the bladder into the right side of the pelvis and there fixed by adhesions in the region of the ramus of the pubis. In addition the lower border of the greater omentum is firmly adherent to the upper surface of the tumor. Finally, it is adherent to the cœcum through the medium of a slip of the omentum. The structures forming the twisted pedicle start from the left border of the uterus in the normal direction (for 2 cm.), then bend at an acute angle, and, gradually growing thinner, terminate at the ovary; the tube is twisted three times around the broad and ovarian ligament.

In this case Röhrig assumes that the tumor diminished permanently in size on account of the torsion of its pedicle. This is proven by the nodular and retracted appearance of the tumor, its thick, calcareous wall, the thick fatty contents, the folds in the adherent omentum, which indicate previous broader adhesions.

4. RUPTURE OF CYSTOMATA.

Rupture of the external wall of an ovarian tumor has been repeatedly observed. But as a general thing, the outer wall, especially if the tumor is of long standing, becomes much thicker and firmer than the numerous septa within proliferating cystomata, because as the secondary cysts are destroyed their walls become added to the main wall. Indeed, the main wall of certain colloid tumors is so thick and firm that rupture seems impossible. The cysts produced by dilatation of Graafian follicles and those of the broad ligament, generally have a thinner wall, but exceptionally it has a uniform thickness of 0.5 cm. or more. In other tumors, particularly the proliferating cystomata, the thickness of the main wall is extremely unequal. Very firm parts alternate with others which are so thin as to be transparent. Finally, certain tumors have very thin, extremely fragile walls, so that the main wall ruptures when grasped during ovariectomy.

The manner in which tumors, rupture, whether from the pressure of the fluid contents, or from injury, varies greatly in different cases. The wall may grow gradually thinner until it yields at its weakest point.

This is not infrequent in proliferating cystomata. Spiegelberg describes a unique case in which, on laparotomy, he found more than thirty perforations, varying from the size of a pea to that of the palm of the hand, in a large cystoma. One or more perforations are found very often in ovariectomies. In one case I recently found a rent admitting four fingers, in the most prominent part of the wall. We very often find places which are very thin and transparent, *i.e.*, on the point of rupture. Perhaps even more frequently than perforations we find the cicatrices of former perforations upon the inner surface of the wall of the main cyst. Cysts with gelatinous contents have a special tendency to rupture.

Morbid processes in the walls may greatly increase the danger of rupture. They are observed particularly in proliferating cystomata. In the first place, thrombi may form in the vessels of the wall. This may result in softening, fatty degeneration, and gangrene of the wall with subsequent perforation. Or a hemorrhage into the cyst is associated with hemorrhagic infiltration of the walls with the same results.

Suppuration within the cyst is also apt to lead to perforation of the walls. But this is less apt to cause rupture into the abdominal cavity than in other cases, because the suppuration generally induces early inflammation of the outer surface of the tumor and adhesions to adjacent organs. The significance of torsion of the pedicle as regards nutritive disturbances in the walls, hemorrhage into the cysts, purulent inflammations and perforation, has been discussed above.

A not very infrequent form of perforation is that by means of papillomata of the cysts in certain cystomata. When these papillary excrescences proliferate freely they readily perforate the main wall, usually by completely filling the small cyst in which they grow and then causing perforation of the wall from within by gradual erosion; more rarely they grow backwards in the wall and perforate it externally.

This process, which is shown in Figs. 13 and 14, is extremely common. Indeed, the papillae not infrequently proliferate further upon the peritoneum or even perforate adjacent organs, such as the rectum, etc. This mode of perforation develops very gradually, with a usually small opening, and, as a rule, is unattended with symptoms.

In addition to blows and falls, other injuries also may cause rupture. It may be produced during labor by the pressure of the uterus or of the forceps. Scanzoni observed perforation into the rectum during spontaneous delivery. The rupture may follow physical exploration. It may also be produced by the pressure of the rim of the pelvis. In two cases West found the cyst ruptured posteriorly where it was firmly pressed against the rim of the pelvis. Smith observed the rupture in that part of the tumor which was in apposition with a fibroid of the uterus.

The results of rupture of the external wall vary according to the direction in which the perforation takes place. Rupture into the peritoneal

cavity is by far the most frequent. The results depend partly on the quality, partly on the quantity of the extravasated fluid.

The most innocuous fluid is the clear serous contents of anatomically unilocular cysts, whether they are dilated Graafian follicles or Wolffian ducts. In such cases the peritoneum is usually not irritated, and the rupture may be unattended with pain. The fluid may be absorbed as the result of increased diuresis. As a general thing the site of perforation then closes and the sac refills, to be followed by more or less frequent discharge into the peritoneal cavity, or the site of perforation remains open, the secretion gradually ceases, the sac shrivels and a radical cure is effected. Goodell mentions two cases, however, in which the rupture of parovarian cysts proved fatal.

J. Y. Simpson reports a case in which paracentesis was performed forty-four times. The patient then fell on the ice upon the abdomen, after which the tumor became much smaller. Since that time the patient passed much more urine and perspired more than before. Simpson assumed that the communication between the cyst and peritoneal cavity continued, and that the peritoneum absorbed as rapidly as the cyst wall secreted.

Rupture into the peritoneal cavity may also be followed by infection of the peritoneum by the contents of the cysts. Among 400 ovariectomies, Thornton found free fluid forty times in the peritoneal cavity. Three of these patients died in consequence of the operation. Of the remaining thirty-seven, three died within a few years from carcinoma, one from general sarcomatosis, one probably from tumor cerebri (metastatic), three others suffered from carcinoma.

That complete recovery can occur only in unilocular tumors, and not in proliferating cystomata, is readily understood. But recovery is exceptional, and re-accumulation of fluid the rule, even in the former cases. If the fluid extravasated into the peritoneum is not serous, inflammatory reaction may be produced. The contents of colloid tumors, if not changed by blood or pus, is also an indifferent fluid as regards the peritoneum, but is not absorbed as readily as serous fluid.

If the colloid matter is mixed with blood, it often irritates the peritoneum, though not so intensely as when pus, ichor or the contents of dermoid cysts are extravasated. The rapidly decomposing fats in the latter variety of tumor are eminently productive of inflammation. If the fluid is irritating in character, its effect also depends on the amount extravasated. But even the rupture of very small cysts may cause fatal peritonitis.

The termination after the extravasation of such substances may vary greatly. The more or less extensive inflammation may subside, or it may prove fatal. Death sometimes occurs so rapidly that it appears to be the result not so much of inflammation as of shock, or of the absorption of

deleterious substances and of poisoning produced in this way. This may take place in ordinary cystoma, especially if a large cyst has ruptured.

The other results of rupture into the peritoneal sac may be: diminution in size or even disappearance of the tumor, or flaccidity of the tumor with less distinct definition of individual parts, and at the same time a change in the shape of the abdomen. Free fluid may be demonstrable in the abdominal cavity. This does not always sink into the most dependent parts, inasmuch as previous adhesions may retain the fluid between the tumor and abdominal walls. Even under such circumstances, it is readily distinguished as free fluid by the sudden appearance of superficial fluctuation and by the fact that the tumor cannot be felt until a layer of fluid has been displaced.

A more remote and extremely important sequel (which is unusually common in papillary cystomata) is the development of metastatic tumors on the peritoneum. Intestinal peristalsis diffuses the extravasated masses very rapidly over the entire peritoneum, and the latter forms a very favorable soil for implantation. This process occurs very rarely in ordinary proliferating cystomata, but is the rule in papillary cystomata. Metastatic tumors almost always develop sooner or later, if the neoplasm is not removed in time.

Next to perforation into the peritoneal cavity, that into the intestines is by far the most frequent. The perforation generally takes place into the large intestine; more frequently into the rectum than into the colon. This mode of perforation is favorable in the case of purulent, ichorous or otherwise deleterious fluids. A cure, at least of the ruptured cyst, may follow. But, on the other hand, the entrance of the intestinal contents may produce gangrene, and death results from long-protracted hectic fever, exhaustion, or a fresh attack of peritonitis.

Rupture into the stomach or upper part of the small intestines is extremely rare. Portal reports a case of very large hydrops ovarii in which ten pints of fluid were suddenly vomited, and fourteen pints within the next five days, after which the tumor was no longer perceptible.

Rupture may also occur externally, either through the lower abdominal region or the navel, into which the tumors occasionally push their way. This mode of rupture is favorable, because the cavity is then susceptible of external disinfectant treatment. Finally, rupture occurs not very seldom into the vagina, and very rarely into the bladder.

We must also make mention of perforation into the tubes, which was discussed under the head of tubo-ovarian cysts. This gives rise to hydrops ovariorum profluens. In West's case the patient had considerable enlargement of the abdomen for six years. This disappeared suddenly during a profuse watery discharge from the vagina, which recurred eight or ten times. The fluid was always colorless, and often amounted to several quarts. The evacuation occurred several times during defecation

or strain, and was repeatedly followed by syncope. West convinced himself of the presence of a tumor which was movable and situated high above the vagina, and later disappeared. It returned gradually in three weeks. The uterus was movable, the vagina contained no opening. West believes that similar cases have sometimes been looked upon as instances of rupture into the vagina. Sachse¹ reports a case in which hydrops ovarii was discharged regularly through the vagina every four weeks, shortly before menstruation. Later the tumor remained large and was punctured through the vagina. After lasting twenty years it shrivelled to the size of a fist at the menopause.

In the majority of cases, rupture into the abdomen occurs slowly and without producing notable symptoms, so that it escapes diagnosis. The statistics of Tilt, Palm and Nepven refer only to severe cases, which were capable of diagnosis. According to Palm, among twenty-five cases of rupture eighteen proved fatal, three acutely from collapse, six from acute peritonitis, three from chronic peritonitis, six from protracted fever, dropsy and marasmus. Nepven collected 155 cases, of which sixty-three terminated fatally. Rupture into the peritoneal cavity occurred 128 times, into the large intestine eleven times, in the remaining cases through the abdominal walls, into the vagina, bladder and uterus.

The diagnosis of rupture into the abdominal cavity depends upon the disappearance of the tumor, its diminution in size or the increasing indistinctness of its contours, upon the demonstration of free fluid in the abdomen, or the occurrence of peritonitis and symptoms of collapse. In many cases profuse diuresis or diaphoresis occurs after a while. Lambert² observed, after rupture, the development of anasarca and profuse diuresis, sixty-five pints of urine being excreted in four days. In one case I noticed a crackling r  le and crackling feeling on palpation; the extravasated masses were thick and jelly-like. This peculiar feeling is produced by the pushing away or compression of gelatinous tough masses (colloid crackling). It is not pathognomonic of the presence of these masses in the peritoneal cavity, since it is also observed in the intact tumor. It then appears to develop from the passage of the tough masses from one cyst through a narrow opening into another cyst, while loops of intestine are situated in such close proximity as to be thrown into vibration. Colloid crackling should not be mistaken for the friction murmur of peritonitic adhesions. The former is a purring sound and feeling, and can be perceived on palpation without the application of the ear. K  ster has recently called attention to another diagnostic sign, *vis.*, peptonuria. On the first day after rupture a feeble but distinct pepton reaction was obtained. Further investigations must decide whether this sign has any diagnostic importance.

¹ Med. Beob. u. Bem. Bd. II., p. 207, 1839.

² Lancet, May 29, 1879.

Rupture into the abdominal cavity is most apt to be mistaken for torsion of the pedicle, particularly as the latter condition may give rise to rupture.

Rupture into the intestines may be easily recognized if colloid masses in large amount, or a chocolate-colored, bloody, thick fluid (which has perhaps been obtained in previous punctures of the tumor), or fat and hair (in dermoid cysts) are passed per anum. In other cases, especially if the perforation occurs high up, and only fluid, slightly tinged masses enter the intestines, a violent watery diarrhœa sets in, the suddenness of which must at least rouse the suspicion of rupture. In rupture into the bladder, the symptoms—vesical tenesmus and dysuria—are much more marked than in rupture into the intestines.

The diagnosis of external rupture is generally absolutely certain. It is only when pus and ichor, but no colloid masses, fat or hair, are alone discharged, that it may be difficult to determine the source of the abscess.

In rupture into the abdomen, when threatening symptoms are produced, and the diagnosis of ovarian tumor and the feasibility of operation had been previously determined, ovariectomy should be rapidly performed.

Under other circumstances the treatment must be symptomatic. In cases of intestinal perforation, careful examination per rectum will show whether the abscess opening is accessible to the finger and instruments. Disinfectant injections should then be made into the abscess cavity to prevent decomposition. Careful attention should also be paid to the general condition of the patient. In perforation externally, the treatment is similar to that of excision or partial extirpation of tumors.

Cooper Rose reports a complicated case in which the right ovary opened into the cœcum and later externally. The left ovary perforated the rectum. The patient died of exhaustion.

Lumpe observed a case in which a woman presented an ovarian tumor after the third confinement, and suffered from an attack of peritonitis. Palliative puncture was soon performed, and eight quarts of grayish green, feculent fluid discharged. Soon after, violent diarrhœa suddenly set in, and similar fluid was evacuated. This continued five weeks, the tumor disappeared, and the patient recovered.

Dudley and Coe report a case of combined perforation of the bladder and intestines.

5. THE DEVELOPMENT OF METASTASES (SO-CALLED MYXOMA PERITONEI).

We must again call attention to the metastases of ovarian tumors, which have been previously discussed under the head of papillary cystomata and rupture of ovarian cysts.

It has long been known that cancer of the ovary may produce metas-

tases on the peritoneum and diffuse carcinosis with rapid development of ascites or cancerous peritonitis. Metastases may also occur in remote organs.

We also learned that papillary cystomata very often extend to the peritoneum. A notable case in this connection was observed by Baker Brown. In a patient aged forty-seven years, he extirpated both ovaries; eighteen months later the abdomen was again enlarged, and this necessitated sixteen punctures in the next seven years. A pailful of thick, dark fluid was discharged at each puncture. Then a hard tumor, as large as a child's head, was discovered in the epigastric region. Laparotomy was then performed and revealed a non-pedunculated, round, red tumor, which was unconnected with the uterus, and started from the pelvic fascia of the left side. Behind the uterus was a cyst, as large as a fist, which was punctured. The tumor was partly torn from its base during removal; the remainder was removed with the knife; severe hemorrhage. A sub-peritoneal cyst, as large as a fist, was also found on the transverse colon. Death occurred five hours after the laparotomy.

The autopsy showed absence of both ovaries and a left hydronephrosis. The extirpated tumor weighed almost two pounds, and its diameter was twelve to thirteen inches. It consisted of numerous cysts, of the size of a pea to that of a goose egg, whose walls (internally and externally) bore branching, papillary structures. Some of the external ones were as large as a hazel-nut, partly pedunculated, partly seated on a broad base. The cyst-walls were lined with polygonal, in part fatty, epithelium; the villi were covered with cylindrical epithelium. Some of the villi terminated in flattened knobs, which contained psammomatous bodies.

Numerous similar cases have been reported, but the secondary tumors are rarely as large as in Baker Brown's case, although the peritoneum is often strewn with hundreds or even thousands of small growths. The parts chiefly affected are the floor of Douglas's *cul-de-sac*, and the posterior surface of the broad ligament, also the general peritoneum, particularly the greater omentum. The fact that these small papillomata contain numerous psammomata, permits a diagnosis even in those parts of the abdominal cavity which are not visible. Thus, in one case I found them on the under surface of the diaphragm; in another case the lower surface of the liver was studded with them, and felt like a grater.

The constant result of this diffuse formation of metastatic tumors on the peritoneum is the development of ascites, which often has a bloody character, and rapidly increases and returns after puncture. The fluid discharged on puncture not infrequently contains shreds of tissue, which are recognized as *débris* of the papillomata.

The papillary formations, after they have perforated the outer wall of the cystic tumor or after a small cyst has been completely everted, break off mechanically, and are rapidly carried by the peristaltic movements of

the intestines to the entire abdomen. They may then become fixed in any part of the peritoneum, and there develop farther. There can be no doubt that even in these benign tumors portions may become detached, implanted in the serous membrane, and there develop into large tumors. There is no question that some apparently pure, papillary cystomata may be mixed tumors, in which parts are carcinomatous, but there is also no doubt that most of the observed cases refer to pure papillomata.

The question next arises, what may become of the small metastatic tumors if the primary tumor is completely extirpated. Do the secondary tumors always continue to grow and lead to further metastases and to constantly relapsing, rapidly increasing ascites? This question may be answered in the negative. A number of cases have been reported in which peritoneal infection had occurred at the time of operation, but the patients remained healthy for many years and showed no return of ascites. Thornton found, on extirpation of a bilateral, ruptured papilloma, which was adherent to the bladder and uterus, that the parietal and visceral peritoneum was strewn with sago-like grains which were, in part, pedunculated. The patient was still healthy four years after the operation. In another case the entire pelvic peritoneum was strewn with papillomata. The extirpated ovarian tumor contained papillary structures in all its cysts. The patient became pregnant, and was delivered without further disease. In a third case Thornton was compelled to leave a metastatic tumor, as large as a walnut, in Douglas's *cul-de-sac*. At the end of three and a half years this tumor had hardly increased in size.

Thornton holds the very plausible opinion that the subsequent growth of the small metastatic papillomata is often prevented by their calcification. At all events, the health may be unimpaired for many years, despite these metastases, and it is even very probable that permanent recovery may ensue. As a matter of course, this will depend chiefly on the diffusion and size of the metastases, perhaps upon their special anatomical structure, their tendency to form psammomata, and the part of the peritoneum attacked. In the majority of cases, however, the metastases continue to grow, the ascites returns, and the patient finally succumbs.

A number of cases of proliferating glandular cystoma have been reported in which, after ovariectomy, gelatinous masses formed in the abdominal cavity, and adhered to a large part of the peritoneum (myxoma peritonei). All the reported cases agree in the fact that the primary ovarian tumor possessed tough gelatinous contents, either mainly or exclusively. In several cases the tumor was very brittle, and in the majority the peritoneal cavity was infected during ovariectomy. The peritoneal changes in question were then found a longer or shorter time after the operation. In the majority of cases the operation was rapidly followed by a fatal termination, but several patients survived for years.

Netzel regards the ovarian disease as distinct from glandular cystoma, and calls it ovarian myxoma.

In the secondary peritoneal affection a large part of the serous membrane is covered with jelly-like masses in the form of gelatinous nodules or vitreous vesicles, from the size of a hemp seed to that of a hazel-nut, with gelatinous contents. As a general thing, a compact gelatinous mass was found covering the abdominal viscera continuously. This is especially thick upon the greater omentum and the intestines. The gelatinous substance *en masse* may form a tumor as large as the uterus at full term. However thoroughly the substance may be removed, a thick covering still remains, especially upon the loops of intestines and greater omentum.

The gelatinous masses are pale yellow or gray, and very tough. A few blood-vessels are visible in them, even to the naked eye, and also a net-work of delicate membranes which support the vessels.

These masses have been described as myxoma of the peritoneum, chiefly because they present a gelatinous appearance and often contain mucin. But Werth has shown that they are not really myxomatous, and has proposed the term pseudo-myxoma peritonei.

I agree with Werth that the occurrence of myxoma of the ovary has not been demonstrated hitherto. I may add that in several ovarian tumors, which were characterized by the absence of fluid contents, and by the smallness of the cysts with tough gelatinous contents, my colleague Ackermann always found the characteristics of cystoma, never those of myxoma.

Werth also disputes the previously accepted notion of peritoneal infection. In a patient, who suffered from a tumor of this kind, and who died twenty-two days after the operation, Werth found that the peritoneum and its endothelium were everywhere intact beneath the gelatinous masses, but that delicate connective-tissue membranes with vascular branches passed from the peritoneum into the gelatinous substance. These membranes were covered with endothelium similar to that of the peritoneum. Werth assumes, therefore, that in this as in all similar cases, gelatinous masses are left behind by the tumor, that they irritate the peritoneum, and produce the vascular membranes which enter the gelatinous masses, and gradually produce their absorption.

I have reported a case of extirpation of an ovarian tumor of the character in question. The operation was so cleanly that, at all events, large quantities of the tumor contents did not enter the abdominal cavity. A thin ascitic fluid, however, was present. After a little more than two years, the patient again presented herself with an equally large tumor. The second laparotomy showed that it was situated in the abdominal cavity, and consisted of tough masses, which were divided into chambers by delicate, vascular membranes of connective tissue. The remaining ovary was healthy. After removing the main mass of the tumor, the

colon and almost the entire intestines were coated with a firmly adherent gelatinous layer, almost of the thickness of a finger. The membranes in the tumor had a regular lining of cylindrical epithelium, which contained large nuclei and were finely granular. Only a small part of the gelatinous substance coagulated on the addition of acetic acid.

All that could be maintained, therefore, was that the tumor had the structure of an ovarian cystoma, which grew in two years from particles, undoubtedly insignificant, that had entered the peritoneal cavity. As a matter of course, the vessels of the peritoneum ministered to the growth of the tumor, but the tumor itself can not possibly be regarded as the product of a peritonitic exudation. The sole possible explanation is the secondary growth of particles which had broken off from the primary tumor.

Another case of metastasis of an ovarian cystoma came under my observation in May, 1884. An ovarian tumor was removed from a woman aged fifty years; ascites was also present (seven and a half pounds removed). The development of the tumor was partly subserous. It was adherent to the omentum, in which was situated a nodule half as large as a hazel-nut, which was also removed. According to Ackermann, both tumors were histologically identical. Both were simple, non-papillary cystomata, with well-developed stroma and small cysts (recognizable only with the microscope in the omental tumor), which were lined with cylindrical epithelium. The patient died forty-three days after the operation from rapid marasmus. The autopsy showed a cancer of the pancreas, but no other metastases on the peritoneum.

The supposition might be entertained that the ovarian tumor was not a pure cystoma, but had contained cancerous parts. Examination of the metastatic tumor, however, showed merely the appearances of a cystoma in the first stages.

Marchand¹ reports an interesting case. In a patient suffering from bilateral papillary tumor, I made an incision, but discontinued the operation on account of its apparent great difficulty. At the autopsy, the lower surface of the diaphragm was studded with a large number of elevations like grains of sand, while to its upper surface adhered a number of smooth round tumors, varying from the size of a pea to that of a bean, and provided with fibrous capsules. These looked like infiltrated lymphatic glands, and, in fact, did contain remains of glandular tissue. But the greater part of these tumors was formed of small alveoli, distinctly visible to the naked eye; they were filled with gelatinous substance, and were separated from one another by thin septa. The alveoli were lined with cylindrical epithelium, which was ciliated in many places. In the smallest alveoli the epithelium was relatively high, in the larger ones it

¹ Beitr. z. Kenntniss d. Ovarientumoren, p. 9.

was low, or even flat. The epithelium sent numerous processes internally, but such proliferation of the epithelium seemed to be connected with the formation of papillæ on the part of the stroma. Like the primary ovarian tumors, those in the diaphragm contained numerous calcareous deposits, which were situated chiefly in the connective tissue.

Another equally interesting case has been reported by Baumgarten.¹ The patient died of marasmus four weeks after ovariectomy. The omentum was adherent to the abdominal walls, and in this locality was found a gray viscid fluid, enclosed in cysts which varied from the size of a pin's

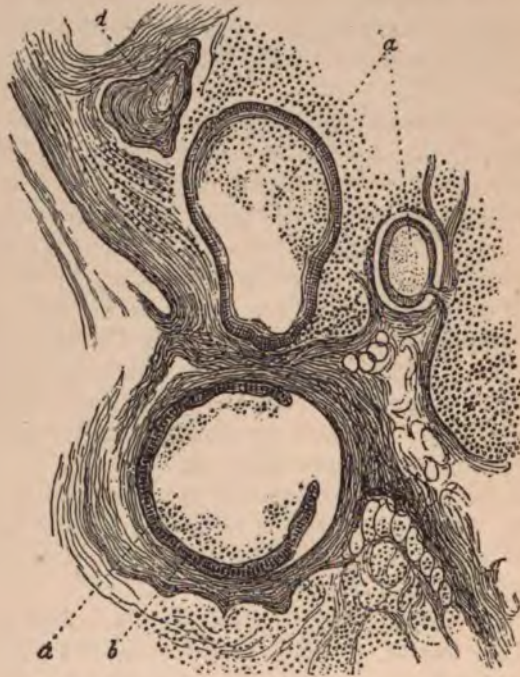


FIG. 20.—METASTATIC TUMORS FROM THE THE UPPER SURFACE OF THE DIAPHRAGM IN PAPILLARY OVARIAN CYSTOMA. (After Marchand.)

head to that of a pea. The walls of these small cysts were sharply defined from the surrounding loose connective tissue. Outside of the peritoneum, but pushing it forwards, were also found several cysts. Microscopical examination of the retro-peritoneal and sub-serous cysts revealed the characteristics of new-formed colloid cysts.

Finally, the dissemination and implantation of dermoid elements on the peritoneum in dermoid cysts of the ovary, have also been observed. In two of Billroth's cases A. Fränkel found multiple dermoids on the

¹ Virch. Arch. Bd. 97, p. 1.

peritoneum, and as chronic peritonitis was present, he attributes them to rupture of the dermoid ovarian cysts.

There seems to be very little doubt, therefore, that the peritoneum may serve for the implantation and further growth of particles of all kinds of ovarian tumors, and that this is especially apt to happen, apart from malignant growths, in papillary cystomata and proliferating cysts with thick, non-fluid contents. These metastatic tumors may also develop outside of the peritoneal cavity, upon the upper surface of the diaphragm, whither they are carried by the lymph current; they remain in the glands, and are capable of further growth.

Werth explains the fact that cysts with tough gelatinous contents are so apt to produce secondary disease of the peritoneum, on the ground that the removal of such masses by the blood-vessels and lymphatics is much more difficult than is that of the thin fluid contents of most cysts. The broken excrescences of papillary tumors cannot possibly be removed from the peritoneum, and hence papillomata have a special tendency to secondary implantation and further growth.

The clinical significance of this form of metastasis is not very great in the ordinary cystoma with gelatinous contents. The number of cases hitherto observed has been very small, despite the frequency of ovarian cysts. Nor is the prognosis, after metastases have formed, as bad as Werth thinks. The observations of Netzel, Marchand and myself, show that the metastases do not always produce severe symptoms, and that life may be prolonged for many years, despite the development of large secondary tumors.

The case is different, however, in metastases of papillary cystomata. These metastatic tumors often develop in very large numbers, grow with relative rapidity, and give rise to ascites, which rapidly increases and returns very quickly after puncture. But these cases also differ greatly in their course. Numerous metastases often form, but after the extirpation of the tumor ascites does not set in nor does a new tumor become noticeable. In one of Thornton's cases a mass, half as large as a walnut, was left in Douglas's *cul-de-sac* after the extirpation of the ovarian tumor. At the end of three and a half years this tumor had hardly increased in size, and had not given rise to any symptoms. Marchand and Thornton found that the small metastases may undergo complete calcification.

Nevertheless, the danger of secondary infection of the peritoneum and consequent incurable disease is greatest in papillary cystomata, and it is, therefore, truer of these tumors than of others that puncture should not be performed, in order that the exit of the cystic contents may not favor the development of metastatic growths.

CHAPTER XVIII.

COMPLICATION WITH PREGNANCY AND LABOR.

ALL forms of ovarian tumor may be complicated with pregnancy. Apart from important clinical results, this complication may present a physiological or anatomo-pathological interest.

The impregnation of a patient suffering from a single large ovarian tumor is a striking fact, but it is still more astonishing to find that pregnancy occurs in not a few cases of degeneration of both ovaries.

Holst¹ found, on autopsy, three cysts, filled with fat and hair, and as large as an apple, in the left ovary, while the right ovary was converted into a medullary cancer as large as a man's head. Normal ovarian stroma could not be found in either ovary. The uterus contained a foetus of eighteen to twenty weeks.

Hofer² found, in a woman aged thirty-six years, two ovarian tumors, the right one as large as a fist, the left one as large as a goose egg. Several years later the woman became pregnant, was delivered with forceps, and died two days later. Both ovaries were found degenerated into tumors, whose combined weight was more than thirteen pounds. The right ovary contained a cyst with two pounds of red, thick contents, and steatomatous outgrowths from its walls. The tumors were intimately adherent to the uterus, vagina and adjacent viscera, and the latter were partly degenerated.

Hewlett³ found malignant disease of both ovaries in a puerperal woman. One ovary filled the pelvis, the other extended from the left iliac fossa to the diaphragm.

Lachapelle⁴ also found both ovaries degenerated in a puerperal woman.

Spiegelberg observed two interesting cases. In one patient both ovaries were found, nine days after delivery, converted into cancerous myxo-sarcomata. Death resulted from peritonitis following rupture of one of the tumors. In the second case the ovaries were found, four weeks after the birth of the eleventh child, converted into irregular tumors as large as a child's head. These tumors were carcinomatous, and in Spiegelberg's opinion, were secondary to cancer of the stomach. Normal stroma could not be discovered in the ovaries.

¹ Beitr. z. Gyn. u. Gebh. Hft. 2, 1867, p. 156.

² Gräfe and Walther's J. d. Chirurgie, III., H. 3. No. 5, p. 422.

³ Med. Chir. Trans. Vol. XVII., 1832, p. 226.

⁴ Pratique des accouch. t. III., p. 383.

As a matter of course, the extent of ovarian disease at the time of conception is a matter of doubt in all these cases. But it is almost absolutely certain that the disease had at least begun on both sides, and perhaps had involved almost the entire organ. The cases show that, despite great degeneration, a minimum amount of normal parenchyma may produce healthy ova. We may also conclude that, if menstruation is dependent on ovulation, it may continue even after advanced bilateral disease, and that the continuance of menstruation despite advanced disease of both ovaries does not disprove the connection between ovulation and menstruation. I have observed a case in which the patient menstruated regularly, despite the presence of two approximately equal ovarian tumors, whose combined weight was sixty pounds.

Spiegelberg believes that ovarian tumors not infrequently grow with unusual rapidity during pregnancy, on account of the increased supply of blood to the genital organs. I concur in this opinion. It is a striking fact that ovarian tumors of considerable size, of whose presence the patients had no previous suspicion, are often discovered during pregnancy or immediately after delivery, and their rapid growth has often been directly observed. The same fact has also been observed with regard to other tumors of the genitalia, especially tumors of the vulva and myoma and cancer of the uterus. Luecke¹ has also called attention to the not infrequent rapid growth of malignant tumors in other parts of the body in pregnant women.

Wernich infers, from the observation of a case, that pregnancy predisposes to the transformation of benign into malignant tumors. But his case is not convincing, and the question must still be left open.

As is readily understood, the majority of cases occur in proliferating cystomata, but dermoid cysts furnish the relatively largest contingent. Jetter found thirty-one dermoid cysts among 165 cases. This frequency is explained by the long duration of these cysts. Moreover, they are often congenital, and thus become apparent at the relatively early age of most pregnant women. The chief factor, however, is the comparatively small size of most dermoid cysts. For this reason these tumors, as a rule, are situated in the pelvis, and are therefore much more apt to produce disturbances and to suffer change than the proliferating cystomata, which are usually situated higher. Hence, a dermoid cyst is less apt to escape observation during delivery than a proliferating cystoma, unless the latter has attained considerable size.

The diagnosis of ovarian tumor during pregnancy is not infrequently attended with considerable difficulty. Whether situated within or without the pelvis its palpation is materially obstructed by the pregnant uterus and the often enormous tension of the abdominal walls. If the tumor is

¹ Monatsschr. f. Geb. XIX., p. 261, 1862.

situated in the pelvis the vagina is rendered tenser by the tumor on account of the downward pressure of the uterus, and the determination of its resistance is rendered more difficult. This appears to be much greater (as is also true of tumors impacted in the pelvis in the non-pregnant condition), so that cystic tumors, even if the walls are thin, may appear to be entirely solid. In many cases the connection of the tumor with the uterus or its relations to that organ cannot be ascertained, because the uterus is situated so high that often the external os can barely be reached. If the tumor is felt in the pelvis between the vagina and rectum, and if it is round and fluctuating or tense and elastic, the diagnosis can almost always be made, since hæmatocele does not occur during pregnancy and the advanced stage of pregnancy excludes the diagnosis of retroversion of the uterus. If the tumor is above the pelvis, it is situated either in front of the uterus or to one side, generally upon the ilium, more rarely at the upper part of the uterus.

The less advanced the pregnancy, and the smaller the tumor, in other words, the less the tension of the abdominal walls, the more readily can we distinguish the boundary between the uterus and ovarian tumor. Towards the end of pregnancy this is often impossible even if the tumor is small. It is only in rare cases that a furrow can be detected between the organs. In Moeller's case the ovarian tumor had been noticed for seven years. During parturition the tumor lay in the left hypochondrium, and was separated from the uterus by a distinct groove. The patient died of peritonitis thirteen days after delivery, and the left ovary was found to be 10" long, 8½" broad, and 5" thick; it was so hard that it could be divided only by a saw. As a matter of course the tumor was not applied closely to the uterus on account of the hardness of the former.

On account of the difficulty in diagnosis, tumors situated outside of the pelvis are generally overlooked until after delivery. In other cases the tumor was noticed, but regarded as a part of the uterus. Nicholson made a diagnosis of hydramnion until the ovarian tumor was recognized after the delivery of a small child with a small amount of amniotic fluid. Still more frequently the tumor has been regarded as part of a second child.

In very large tumors it may be evident that the abdominal cavity contains some abnormal body in addition to the pregnant uterus, but the enormous tension of the abdominal walls does not permit a positive diagnosis of ovarian tumor. But if elastic resistance is encountered everywhere or over a great part of the abdomen—fluctuation is apt to be prevented by the great tension—the diagnosis of ovarian tumor is so much more probable, the greater the size of the abdomen. The side on which it is situated is recognized with comparative ease, since the tumor is almost always to the side of the uterus. In one case of bilateral cystoma, however, Schroeder found both tumors on the right side, the pedicle of

the left tumor running behind the uterus. The tension of the abdominal walls is sometimes so great that no diminution is noticed, even after the delivery of the child and placenta.

The results of the complication are not always noticeable, but in some cases they are of the most serious character.

The usual disturbances of pregnancy are not infrequently greatly increased. Many women, who were unaware of the existence of a tumor prior to pregnancy, notice very soon the increase in the size of the abdomen, dyspnoea occurs at an early period, and, in some cases, has been so excessive that premature delivery was induced in order to prevent death from suffocation. Varicose veins and oedema of the legs are often observed; more rarely the patients suffer severe pains, generally as the result of torsion of the pedicle and subsequent peritonitis.

Apart from such symptoms the tumor and the pregnant uterus may react upon one another in different ways. In a series of cases abortion is produced. According to Jetter, among 215 pregnancies in 165 patients, abortion occurred twenty-one times and premature delivery fifteen times. One or more abortions were very often followed by pregnancies of normal duration. An unfavorable termination after abortion may be the result of internal hemorrhage or collapse, torsion of the pedicle or rupture of the tumor and peritonitis, or suppuration of the tumor. In a case of abortion (sixth month) complicating a cyst as large as a man's head, Habit observed death from collapse at the end of thirty-six hours. The autopsy revealed hemorrhage into the cyst and peritonitis. Ruge observed a fatal termination, apparently from shock, after abortion in the sixth month; no internal hemorrhage was found on autopsy. Dance lost a patient, after abortion, from hemorrhage and suppuration of the tumor.

If pregnancy is not interrupted, the influence of the tumor on labor depends chiefly upon its situation inside or outside of the pelvis. The gravity of this complication was formerly over-estimated. Litzmann's statistics, according to which twenty-four mothers out of fifty-six died during labor, are undoubtedly incorrect, and even Jetter's more favorable statistics are not reliable. According to the latter, among 215 mothers sixty-four died, and in eleven the issue was doubtful. In former times only the specially difficult and therapeutically interesting cases of this complication were published. But a larger number of favorable cases have been reported in recent times. Among eleven cases Rogers and Braxton-Hicks observed no fatal results, and Spencer Wells only three among eleven or twelve cases.

While the small tumors merely interfere mechanically with labor by obstructing the genital canal, the larger ones mainly influence the vigor of the labor pains and the direction of the propelling force by producing an abnormal position of the uterus.

Still more important is the effect of the pregnant uterus and of labor, perhaps also of the puerperal state, upon the ovarian tumor. Its compression may cause hemorrhage into its substance and cavities, still more frequently rupture with secondary peritonitis. Suppuration or gangrene occurs not infrequently, especially in dermoid cysts. Finally, dangerous torsion of the pedicle may be produced.

All these sequelæ may have the previously described results and terminate sooner or later in death. But in rarer cases torsion of the pedicle and rupture may lead to permanent diminution in the size and cessation in the growth of the tumor.

Rupture into the abdominal cavity followed by recovery has been observed by various writers. In Tufnell's¹ case severe peritonitis set in, but pregnancy was not interrupted and the patient recovered. Eulenburg² and Carson³ observed recovery after rupture.

But the large majority of cases of rupture into the abdominal cavity terminate fatally. This is the constant termination after rupture of dermoid cysts.

Rupture of the tumors may also occur in other directions. Dermoid cysts are especially apt to rupture into the intestines or vagina. Rupture into the vagina in the case of proliferating cystomata has been observed by Langley,⁴ Ashwell⁵ and Headland;⁶ into the bladder with favorable termination by Clay;⁷ into the intestines by Fraser and E. Martin.

Moller reports an interesting case of fatal termination after torsion. A tense tumor, as large as an apple, which could not be replaced, was felt behind the portio vaginalis. Living twins were removed with the aid of forceps. Three days later death from septicæmia. Diffuse peritonitis and a dermoid cyst in each ovary were found on autopsy. The tumor which had been felt was nodular and situated on a twisted pedicle 3" in length.

A case has also been reported in which death was the result of ileus. Hardey⁸ had replaced a retroflexed uterus at the beginning of pregnancy. The foetus was carried to full term, but the mother died of ileus fourteen days after delivery. The intestines were found twisted around the pedicle of the tumor.

In rare cases death results from rupture of the uterus.

A favorable termination may result unexpectedly from the spontaneous passage of the tumor out of the pelvis. Playfair observed spontaneous reposition after the child's skull had been perforated, Lee in a patient in whom perforation had been performed during the previous pregnancy.

¹ *Dubl. Journ.* VIII., p. 460.

² *Wien, med. Wschr.* 1857, 43.

³ *Constatt's Jb.* 1846, 3, 244.

⁷ *Lond. med. and Surg. J.* VI., 319, 1834.

² *Guy's Hosp. Rep.* No. 2.

⁴ *Med. Times*, May, 1844.

⁶ *Lond. Obst. Trans.* I., p. 226.

⁸ *Lond. Obst. Trans.* 1865, p. 267.

The recession of a tumor, which is situated below a skull which is pressing forcibly against the superior strait, can only be explained by its cystic character and the consequent possibility of considerable change of shape, if the wall of the tumor is yielding or flaccid. This is analogous to the process occurring during the delivery of a very large hydrocephalic skull.

In rare cases, finally, room is made for the passage of the child by rupture of the floor of the pelvis and exit of the tumor below. In a case of forceps delivery Berry¹ observed the passage of the ovarian tumor through the posterior vaginal wall into the vagina; the patient recovered after ligation of the tumor. Lomer reports a similar occurrence; as in Berry's case, this was a dermoid cyst. Kerswill² noticed that the tumor caused protrusion of the posterior vaginal wall and punctured it; the child was then delivered with forceps. Ten days later the thick-walled cyst, with a pedicle 2" long, was passed through the vagina. A unique case is cited by Lachapelle;³ a tumor of bony consistence and 14" in circumference was passed through the anus.

In the complication of ovarian tumor with pregnancy the indications for treatment may be the prevention of suffocation or the relief of ileus, or of peritonitis dependent on rupture of the tumor or torsion of the pedicle.

These indications may be met in three ways: the induction of premature delivery or abortion, puncture, and ovariectomy. R. Barnes has resorted to premature delivery, and Hecker, Hartmann and Höniger and Jacobi have each employed it in one case. Hartmann's patient recovered; Hecker's died of peritonitis nine days after delivery, and the autopsy showed that a part of the sac as large as a hen's egg was situated in the inguinal canal. In the third case the tumor was cancerous; death occurred four days after delivery.

Spencer Wells strenuously advocates puncture of the tumor, at least in cases in which the relief of dyspnoea is the most pressing indication. Premature delivery should be induced only in the rarest cases, which will soon be described in detail. But if the interruption of pregnancy seems to be indicated, the production of abortion is as favorable as that of premature delivery, since, as a rule, the hope of preserving the life of the child is illusory.

Puncture, on the other hand, may be extensively used. Although merely palliative, it is often imperatively indicated on account of dyspnoea. The relief of the latter is often very marked and sometimes persists during the last weeks or months of pregnancy. In other cases it must be frequently repeated. Its dangers are hardly greater than in the non-

¹ Lond. Obs. Trans. VIII., 261.

² Cbl. f. Gyn. 1880, No. 26.

³ Prat. des accouch. III., 311.

pregnant state, and there is no danger of injuring the uterus with the trocar unless pregnancy is overlooked. But if the boundaries of the uterus cannot be felt distinctly, it is well to choose a point of puncture which will enable us to avoid the uterus, either near the spinous process of the ilium, if the uterus is pushed to the other side, or above the umbilicus.

The course of pregnancy is hardly ever interrupted by the puncture. Indeed, it is the only efficient means of preventing abortion, which is always threatened by the great tension of the abdominal walls and marked dyspnœa. In a few cases, it is true, puncture has been followed after a time by abortion, but it is questionable whether this was not the result of the growth of the tumor.

There is no doubt at the present time that ovariectomy during pregnancy offers favorable chances. Among eighty-two cases seventy-four were successful. This result is so much more favorable inasmuch as some of the cases were operated upon prior to the period of antiseptics. In two of the fatal cases, moreover, the pregnant uterus was regarded as a part of the tumor and was punctured, and, finally, Thornton lost a patient after torsion of the pedicle, who was operated upon in a moribund condition. Among thirty-six cases operated on by Tait, Spencer Wells and Schroeder, only one died.

Even the life of the fetus is jeopardized in very few cases, and pregnancy runs its normal course in the majority of cases. Despite the fact that the uterus was injured in a number of cases, pregnancy was interrupted in not above twenty per cent. of the cases.

Some of the tumors removed were quite large (forty, fifty, even eighty-one pounds). In numerous instances the pregnancy had not been recognized. In one case, indeed, it was unnoticed even during the operation, and was not discovered until the birth of a full-grown child thirty-one weeks later. In seven cases the uterus was mistaken for an ovarian cyst and punctured. The majority of operators then performed Cæsarean section, sewed up the uterus, and closed the abdominal incision. Five of these patients recovered.

Wilson regards the operation as less favorable after the fifth month, and Schroeder points out that in advanced pregnancy the ligamenta lata are more unfolded and the pedicle therefore shortened in an unfavorable manner. There is no doubt, also, that if adhesions are present the greater congestion of the organs towards the end of pregnancy will act unfavorably. Nevertheless, of twenty-one cases operated on after the fourth month only two proved fatal. Pippingskoeld operated successfully probably after the beginning of labor, since the child was born seven hours after the operation.

In accordance with experience the treatment becomes very simple and precise. In view of the great dangers attending the complication of

ovarian tumor with pregnancy, ovariectomy, as a rule, is the only proper treatment, and, if possible, should be performed in the first months of pregnancy. The smallness of the tumor is not a contra-indication, since it is in these that the main danger, *viz.*, that of torsion of the pedicle, is the greatest.

In some cases the operation may be deferred until after child-bed; this is most apt to be justifiable if the diagnosis of parovarian cyst is probable and symptoms are wanting. In case of necessity ovariectomy may be performed even during child-bed. Nussbaum operated successfully on the twelfth day after delivery.

A delay of the operation may also be advisable if the tumor is totally adherent as the result of previous peritonitis, especially if it is situated above the pelvis and pregnancy is far advanced. But Schroeder's experience shows that a favorable result may be obtained even in such cases. On the other hand, symptoms of torsion of the pedicle or suppuration of the cysts may necessitate rapid action.

Puncture through the abdominal walls may be performed in advanced cases or in parturient women if violent dyspnoea calls for relief, and the presence of distinct fluctuation renders the case suitable for this operation. This is especially true of large tumors, when other circumstances make ovariectomy impossible at the time.

Induction of premature delivery should be reserved for those rare cases in which extirpation is impossible and puncture does not seem advisable, and in which the irreducible tumor in the pelvis must inevitably prove a great obstacle to delivery. This holds good almost entirely of solid tumors and dermoid cysts, which are situated in the pelvis and irreducible.

Energetic treatment during delivery may also be necessary. Almost all obstetrical operations have been resorted to, the forceps, version, perforation, even Casarean section. When the tumor obstructs the pelvis we should above all endeavor to replace it, as has been done successfully in a number of cases. Breisky's case shows that this may also be done during pregnancy.

If the tumor can not be replaced and is not certainly known to be solid, it should be punctured through the posterior vaginal wall. Lomer properly insists upon this plan, because even cystic tumors are apt to appear solid when incarcerated in the pelvis. When the thick contents, for example in dermoid cysts, can not flow through the trocar, the opening should be enlarged, and, if necessary, the tumor removed forthwith.

Delivery with the forceps should not be resorted to, since its results can never be foretold, and it is very apt to produce rupture. This plan can only be justified in the case of solid tumors when the space left for the passage of the child is not too small.

The same remarks hold good concerning version, except that this operation is somewhat more justifiable. In all cases of great obstruction,

which can not be relieved by reduction or puncture of the tumor, the child must be made smaller. The indication for Cæsarean section will hardly ever be presented. Kob was compelled to resort to this plan after vainly attempting puncture and incision of the tumor through the vagina. Lahs¹ also performed Cæsarean section, without having tried puncture of the tumor through the vagina; after the operation he punctured the tumor through the abdomen. Jetter reports three other cases of Cæsarean section.

¹ Deutsch. med. Wschr. 1878, No. 49.

CHAPTER XIX.

COURSE.—DURATION.—TERMINATIONS.

MANY patients remain free from all intercurrent conditions and complications, and at the most suffer some pain in the later stages of the disease from apyrexial, chronic, circumscribed peritonitic irritation. In such cases the disease progresses more or less rapidly, the tumor either growing steadily or ceasing to grow at times. Symptoms are absent for a long time and later are produced merely by the size and pressure of the tumor. Some patients carry their burden for years, without even losing the ability to work. This is especially true of hydrops folliculorum or cysts of the broad ligament, which grow much more slowly than proliferating cysts. In rarer cases inflammations occur at an early period, and the pains become severe and constant. Or the symptoms become annoying on account of the rapid growth of the tumor itself. The abdominal and thoracic viscera have less time to accommodate themselves to the new conditions of pressure, and even a small tumor causes torture.

The duration of the disease, if the tumor is not removed, is determined with difficulty, inasmuch as its beginning is hardly ever recognized with certainty. The first stages almost always run a latent course. T. S. Lee has endeavored to ascertain the duration of the disease in a series of cases. Among 131 patients the fatal termination occurred in thirty-eight at the end of one year, in twenty-five at the end of two years. Seventeen patients lived three years, ten lived four years, twenty-seven lived five to sixteen years, two lived twenty-five years, and one thirty years. Among 175 cases John Clay gives the duration of the disease until the performance of extirpation as follows: one year thirty-two cases, two years forty-two cases, three years twenty-eight cases, four years nineteen cases, four to ten years thirty-nine cases, more than ten years fifteen cases.

In rare cases the tumors grow with extreme slowness. J. P. Frank mentions a patient who bore an ovarian tumor from the age of thirteen to eighty-eight years. Apart from dermoid cysts such cases occur almost exclusively in parovarian cysts and simple ovarian cysts. In very exceptional cases this may also happen in obliterated proliferating cysts. I have had one patient aged forty-eight years, who at her death had known of the existence of the tumor for nineteen years. This tumor was one

of the largest of its kind which has come under my observation, and my estimate of its weight (35 kilo.) is probably too low. It had not increased in size during two and a half years. The uniform, distinct fluctuation, and the absence of all irregularities, render it extremely probable that it was hydrops folliculorum or a cyst of the broad ligament.

In some cases, on the other hand, the growth of the tumor can be recognized in a very short time. In one of my patients, in whom the first symptoms were noticed six months previously, I detected a considerable growth of the tumor in ten days, so that the circumference of the abdomen had increased in that time from 92 cm. to 100 cm. At the same time the general condition, the dyspnoea and helplessness, had increased enormously in this period. Ovariectomy disclosed a colloid tumor with one predominant cyst.

It is not going too far to say that 60 to 70 per cent. of the patients suffering from proliferating cystoma die within three years after the first symptoms appear, and that another 10 per cent. die within four years.

The course of papillary cystoma, when intra-ligamentary, is somewhat slower. They generally grow remarkably slowly, and at the end of years may not be larger than a child's head. Then they may remain at this size for years. But the patients occasionally suffer from profuse menstruation; more frequently, in the later stages, from ascites, which returns very rapidly after puncture. The disease finally ends in marasmus, but its average duration is much longer than in proliferating cystomata. One of my patients, with an unilateral, not very large papilloma, had been punctured seventy-six times in six years. In another patient 105 punctures had been made in seven years; twenty-five to forty pounds of fluid were removed each time. In another case I observed the development of the tumors almost from the start. After more than five years they were not larger than a child's head.

The average duration of parovarian cysts is much longer. They often remain almost entirely unchanged for years, especially when they frequently rupture. I have observed cases in which, according to the patient's statements, rupture occurred more than a dozen times; as a rule, this is followed by prolonged relief.

In various ways an ovarian cystoma may heal spontaneously or pass into a condition which is equivalent to recovery. True spontaneous recovery undoubtedly occurs from rupture of the cysts. As a matter of course, this is true of simple cysts alone, not of proliferating cysts. Recovery from torsion of the pedicle may also occur in colloid tumors. But this termination is extremely rare, and recovery is not absolute. The tumor simply shrivels and then remains *in statu quo*, the walls sometimes undergoing calcification. This has been observed repeatedly on autopsy. Rokitsky says: "The ovaries are not infrequently found degenerated in old women into an agglomeration of smaller and larger

cysts, varying from the size of a walnut to that of a fist, and situated in an extremely hard and dense stroma. The walls are also hard and rigid, and papillary proliferations which may be present on the inner surface are converted into hard nodules. These structures must be regarded as degenerated, shrivelled cystoids." Virchow says: "It is certain that absorption of the fluid sometimes occurs. If cholestearin crystals were deposited in the fluid, these are not absorbed, but remain behind. In this way I explain certain small, steatomatous tumors which I have found occasionally in the ovaries, and which are distinguished from cholesteatoma, chiefly by the absence of the non-nucleated, hexagonal epidermoidal cells. Similar collections of cholestearin are also found in the thyroid gland after colloid tumors."

It is questionable whether recovery may also occur from spontaneous absorption of the fluid and cessation of the secretory activity of the inner surface of the cysts. The cessation of secretion on account of disappearance or fatty degeneration of the epithelial lining I have previously alluded to as possible, but have regarded it as doubtful in colloid tumors, which have finally become unilocular. In hydrops folliculorum this secretory function may cease for years and even permanently. But the case stands differently with regard to complete absorption of the fluid. Various writers refer to the occasional flaccidity of certain cysts, and mention this as proof of at least partial absorption of the fluid. Among others Ritchie¹ described a case in which he observed very considerable changes in the size of the tumor. The circumference of the abdomen was 54" and diminished 16" in three months; it then increased 11" in eight months, again diminished 14" in three weeks, and finally in one year and a quarter grew 16½". The autopsy showed no trace of rupture. But it must be remembered that for one and a half years the tumor had been increasing in size, so that the cicatrices of old rupture may have become indistinguishable. Since we know that rupture occurs frequently, and that it is usually latent, all cases of increasing flaccidity must be suspected to be the result of rupture, and absorption without rupture or torsion of the pedicle must be regarded as entirely unproven.

But under all circumstances spontaneous recovery is extremely rare, even in unilocular cysts. In proliferating cystomata it can never be hoped for.

Without surgical treatment death occurs in the larger majority of cases from exhaustion. This is the result of anorexia, impaired digestion, sleeplessness, and interference with respiration and circulation. Bed-sores and intercurrent diseases, especially respiratory affections and intestinal catarrh, often accelerate the fatal termination. But such terminations are very rare in the present condition of medical science.

¹ Edin. Med. Journ. 1870, p. 849.

In other cases death is the result of peritonitis after torsion of the pedicle or rupture, or of metastases upon the peritoneum. More rarely it is caused by intestinal occlusion or embolism of the pulmonary artery. In former times many patients died from suppuration of the cysts after puncture. This is now extremely rare.

CHAPTER XX.

PAROVARIAN CYSTS (CYSTS OF THE BROAD LIGAMENT, CILIATED EPITHELIUM CYSTS).

THE cysts of the broad ligament are so closely related clinically to ovarian tumors, that they should be considered in a text-book on diseases of the ovary.

Apart from Morgagni's hydatids, which originate in the upper part of Müller's strand (pathological enlargement of this part is unknown), the large majority of cysts of the broad ligament belong to the parovarium, *i.e.*, the rudimentary organ derived from the sexual part of the Wolffian body. So long as these cysts are small they are situated in the lateral part of the broad ligament, at quite a distance from the uterus. In addition cysts are found occasionally in the median part of the broad ligament, and are attributed to the primary renal portion of the Wolffian body (the so-called epoophoron). Whether these can grow to such a size as to be clinically demonstrable has not been positively settled.

Nor do we know whether cysts of the broad ligament may be produced by hæmatomata, although this mode of origin is conceivable.

After birth the parovarium is enclosed in that lateral portion of the broad ligament which serves the ampulla of the tube as a mesentery. The organ consists of a number of canals, the largest of which has a triangular shape; its base is parallel to the lateral end of the tube, while the lateral borders, which bend at an acute angle, converge towards the hilus of the ovary. Within this triangular space run ten to fifteen short straight canals, which converge towards the hilus of the ovary, and into which parts of the parovarium not infrequently enter.

The canals have a diameter of 0.3 to 0.5 mm. Their walls are 0.05 mm. in thickness, and consist of an external annular membrane, an internal membrane of longitudinal fibres and ciliated epithelium. Their scanty contents coagulate on the addition of acetic acid.

Small cysts produced by dilatation of one of these canals are often seen during ovariectomies. But even cysts which require surgical treatment are not rare. Among 284 tumors of the ovary and parovarium, operated upon by me. there were thirty-two cysts of the latter organ (11.3 per cent.)

A tumor which is sufficiently large to produce clinical symptoms is

almost always a unilocular cyst without any secondary cysts, but two or three of the smaller cysts are often found in the same broad ligament. In a few cases of extirpation of parovarian tumors, however, one or more small cysts have been found in addition to the main cyst. Tait¹ has described a case in which five or six cysts, whose walls were as thin as paper, were found in the same broad ligament.

The cyst, which is almost always simple, is distinguished from ovarian cystomata by the following anatomical characteristics: its wall is very thin and is generally lined internally with ciliated epithelium, either exclusively or combined with ordinary cylindrical epithelium. Glandular and papillary formations are generally absent entirely. The cystic con-

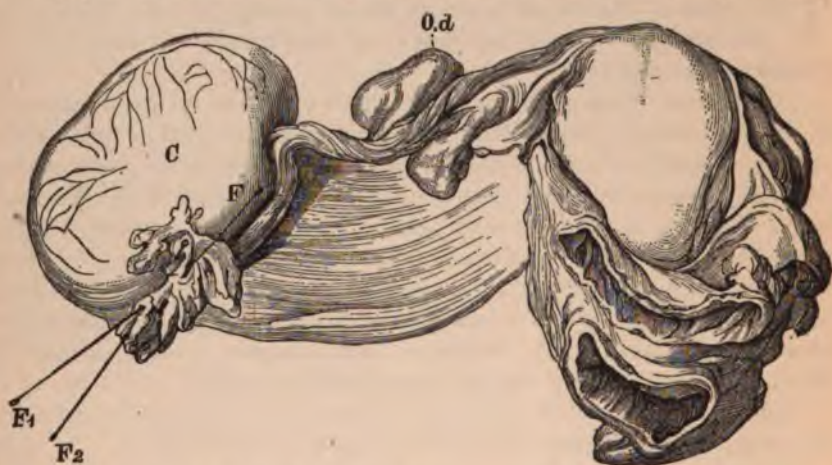


FIG. 21.—PAROVARIAN CYST. *c*, Simple cyst of the parovarium; *O.d.*, right ovary; *u*, uterus; *F*, *F1*, *F2*, fimbriae with triple opening.

tents are very thin, colorless, unusually clear, and of very light specific gravity (1002 to 1008), generally 1004 or 1005. The fluid is usually opalescent, and often does not contain any albumin, which is precipitated by boiling or acids; still more frequently, perhaps, it contains no paralbumin. Morphotic elements are almost entirely absent. The entire surface of the tumor is covered with peritoneum, which may be removed, as a rule, with great ease. On account of its peritoneal covering it does not present, on laparotomy, a pure white or bluish white surface, but has a greenish white color, and the fine vessels of the peritoneum are clearly visible in its envelope.

In the majority of cases the extra-peritoneal development of the tumor does not prevent its pedunculation, although this is not analogous to that of ovarian tumors. In the majority of cases it depends merely on the

¹ "Diseases of the Ovaries," p. 51.

distension of a portion of the broad ligament. If the beginning of pedunculation is alone present, the pedicle may often be made more complete by traction during extirpation. Pedunculation is absent much more frequently than in ovarian cystomata. The tumor develops in the broad ligament, and often distends the latter considerably. If it is large, it may pass beneath the floor of Douglas's *cul-de-sac* to the rectum, cæcum, and retro-peritoneal space, and is especially apt to develop extensively in the mesentery of the colon.

The tube is much more closely related to parovarian cysts than to the majority of cystomata. Its mesentery is completely unfolded in the beginning of the development of the cyst, whence the lateral portion of the tube becomes closely applied to the cyst. As a result it is often very much elongated, and may attain a length of almost 40 cm. Its lumen remains permeable and is very little or not at all stenosed, but the walls are somewhat thinned by the traction. The extended tube surrounds the entire anterior surface of the tumor, the fimbriæ being situated at the external and posterior periphery. As the mesosalpinx, with the exception of a small median portion, is generally unfolded, the tube cannot be lifted up from the tumor, although it can be easily seen and felt in its entire course. The fimbriated extremity may retain a certain degree of mobility. In the majority of cases, however, the abdominal end of the tube and even the individual fimbriæ are closely applied to the tumor, so that their folds are obliterated to a certain extent. The fimbriæ ovarica may be 10 cm. long. Exceptions to this condition rarely affect the entire tube.

The ovary is also drawn towards the tumor developing in the broad ligament, and not infrequently is in direct contact with it. The entire surface of the ovary is often applied to the tumor, and its shape is changed by the traction. Its length may be doubled, its breadth and thickness diminished. The narrow flat organ may then be entirely overlooked.

In exceptional cases the wall of the cyst is unusually thick; the thickness is almost always uniform, and thin transparent patches are not observed.

Still more frequently the inner surface presents deviations. Papillary formations, sometimes very extensive, are not rare, but, as a rule, the papillæ are low and do not branch. Fischel alone has observed glands in the external wall. He found the glandular tubes partly branched and provided with cylindrical epithelium. Muscular fibres were seen by Spiegelberg and Fischel in the outer wall of the sac. The latter writer found them very abundant, and attributes to their presence the corrugation of the inner surface of the cysts. I doubt the correctness of this view. Corrugation of the inner surface is observed in almost all large and especially unilocular cysts, including ovarian cysts, even if the development is not subserous and the muscular tissue is not hyperplastic. There can be no

doubt that this tissue does not pertain to parovarian cysts as such, but consists of hypertrophic muscular fibres, which are found in all reduplications of the peritoneum, especially between the layers of the broad ligament. In subserous ovarian cystomata there is not infrequently a much greater hyperplasia of this muscular tissue, so that the flesh color of the ligament is visible to the naked eye.

The contents of parovarian cysts may present another, not unimportant deviation. The ordinary fluid contains very little solid matter. Thus, in Gusserow's case the fluid, which had a specific gravity of 1002, contained 1.336 per cent. organic matter, 0.946 per cent. inorganic matters. In Schatz's case, on the other hand, the specific gravity was 1022, and the fluid contained 4.827 per cent. solid matters; in the main cyst of this parovarian tumor the specific gravity of the fluid was 1031, the amount of solid constituents 8.802 per cent. The fluid was brown, ropy and thick; no paralbumin. It contained serum, albumin and fibrinogenous substance. I have repeatedly found fluid of high specific gravity in parovarian cysts. One tumor, which weighed thirteen pounds, had opaque, brownish green, tough contents, with a specific gravity of 1023. On boiling, the entire mass coagulated into a firm gelatinous mass. This peculiarity was occasioned by the abundant development of papilla which covered parts of the cyst-wall as large as the palm of the hand.

In another case the fluid had an intense bloody color, and, in addition, old and recent clots were discharged from the cyst. This was secondary to torsion of the pedicle, which had also caused great discoloration of the cyst-wall.

It is probable that similar causes, intra-cystic hemorrhages after torsion, puncture or the formation of papillomata, alone may produce such marked changes in the contents of parovarian cysts.

Parovarian cysts grow with unusual slowness, and are often apparently stationary for years; unless very large, they give rise to no symptoms. As a rule, the cyst is quite flaccid (*kystes uniloculaires flasques* of Cruveilhier). Fluctuation is extremely distinct and easily recognized by the eye; the wave is short and superficial. Hence the fluctuation is similar to that of ascites. On account of the flaccidity and thinness of the walls of the cyst, a change in position may cause a certain amount of change in percussion, and thus increases the resemblance to ascites. The abdomen is relatively broad, as in ascites, and changes its shape on change of position.

The tumors have a great tendency to spontaneous rupture. I have seen cases in which rupture occurred dozens of times, either spontaneously or on slight provocation. Cicatrices are seen not infrequently on the thinnest parts of the walls of the tumor. The rupture takes place without notable symptoms, and the fluid usually is rapidly absorbed, diuresis being greatly increased.

The tumor returns very slowly after rupture or puncture. Months or years (even six to eight years) elapse before its return, and radical recovery has been observed in a number of such cases. It is in the case of parovarian cysts that electro-puncture has been attended with easy triumphs. Nevertheless the number of radical recoveries without extirpation or excision of the cysts is small.

The subserous development of these tumors and the absence of a long pedicle protects them, as a rule, against torsion, although a few cases have been observed. Perhaps this explains the extreme infrequency of adhesions, which are often entirely absent in the largest cysts.

The large majority of the tumors are moderate in size, partly on account of the frequent ruptures. In a few instances the tumors have been very large. Thus, Mundé¹ removed thirty-eight pints of fluid by puncture, and Reverdin removed 22 litre.

Little is known concerning the etiology. It hardly ever occurs in childhood, but Koeberlé operated on a girl of fifteen years. The first years after puberty seem to confer a certain predisposition, but no period is exempt, although old age is not often attacked. Among thirty-seven cases, two occurred below the age of twenty years, eight between the twentieth and twenty-fifth years, six between the twenty-sixth and thirtieth years, eleven between the thirty-first and fortieth years, four between the forty-first and sixtieth years, and one at the age of sixty-one years.

A parovarian cyst is sometimes associated with ovarian disease on the same or the opposite side. Goodell makes the astonishing statement that in parovarian cysts the ovary on the opposite side is usually degenerated.

The diagnosis may be generally made with approximate, sometimes with entire certainty. It is based on the thin walls and flaccidity of the tumor, its slow growth, the absence of symptoms, and especially on the unusually distinct and superficial fluctuation and the absence of hardness in the growth. The diagnosis is made still more certain by the youthful age of the patient, and the repeated ruptures, which are unattended with reaction. When the tumor is small the uterus is generally situated to one side. In addition, the high position of the uterus favors the diagnosis of a tumor in the broad ligament. But such cases rarely come under our observation. The diagnosis is positive if the unenlarged ovary can be felt on the side of the tumor. In some cases the diagnosis cannot be made until after puncture. Finally, the character of the fluid removed may determine the diagnosis, unless the fluid has been changed by intracystic hemorrhages. In the majority of cases a tolerably certain diagnosis may be made from the clinical history and a single examination of the patient.

In the treatment of parovarian cysts extirpation is rivalled by other surgical measures, particularly by puncture. There is no doubt that this

¹ Amer. Journ. of Obstet. XVI, 1883.

sometimes produces a radical cure, but a relapse follows in the large majority of cases. As a rule, therefore, the experienced operator prefers extirpation.

In pedunculated parovarian cysts, extirpation is usually a simple and harmless operation, if septic infection can be prevented. Special stress must be laid upon the latter point, since it almost appears as if the healthy peritoneum is more susceptible to septic influence than after it has been changed by repeated inflammations. Hence in the first period of anti-sepsis cases of acute sepsis occurred occasionally, even after the easiest and shortest parovariotomies.

The case is different when the tumor is not pedunculated, but must be enucleated more or less completely on account of extensive development towards the retro-peritoneal space, or into the mesentery. Here it is possible to injure adjacent viscera, especially the intestines. Furthermore, the tumor can not be enucleated from the mesentery as easily as from the broad ligament. It is especially in such cases that, after the abdomen has been laid open, and the condition of affairs recognized, other modes of operation have been adopted. These include the excision of a small piece (from the size of a dollar to that of the palm of the hand) from the wall of the tumor (Spencer Wells), the removal of the projecting free part of the tumor, stitching of the remainder to the abdominal wound, and drainage externally. The latter method has been recommended chiefly for the reason that the extra-peritoneal space is less capable of the absorption of fluids than the peritoneal cavity. In our opinion, another operation deserves the preference. If total extirpation is attended with great difficulties, the sac of the cyst should be excised so far as it is loosened, and the remainder left behind, without interference with its connection with the abdominal cavity. The secretion, which still continues for a time, will be rapidly absorbed from the peritoneal cavity, and the remains of the cyst will shrivel up. We do not mean to deny, however, that external drainage, in experienced hands, will be followed by rapid recovery. We have also obtained successful results in one or two cases from Spencer Wells's plan, but in recent cases we have completely extirpated parovarian cysts. The details of the operations will be furnished in subsequent chapters.

DIAGNOSIS OF OVARIAN CYSTOMATA.

The diagnosis of ovarian tumors has been rendered very much more certain during the last twenty years, but he who exhausts all exploratory aids and pays careful attention to the clinical history, is alone secure against error. Nevertheless, unusual conditions and complications sometimes lead us astray, or certain factors, especially very thick abdominal walls, render a positive diagnosis impossible.

CHAPTER XXI.

GENERAL DIAGNOSIS.

THE physical signs of an ovarian cystoma vary according to its size and position. We may distinguish two stages, according as the tumor is still situated in the pelvis or has left it in part or entirely.

First Stage. The tumor is entirely within the pelvis.—The position of an ovarian tumor is not always the same under such circumstances. At the outset the ovary may retain its normal position, or it is slightly displaced, usually posteriorly and inferiorly. Tumors which are larger than a hen's egg have almost always moved downwards and backwards, *i.e.*, into Douglas's *cul-de-sac*, and are often in the median line, immediately behind the uterus. In rarer cases they are situated in front of the uterus, but always to one side. This displacement only occurs when the ovary is fixed by inflammatory processes above the upper edge of the broad ligament and anteriorly, or (and this happens more frequently) when the uterus is retroverted before the development of the tumor, and the latter, at the same time, has not descended.

A slightly enlarged ovary, which is in the normal position, may be easily recognized according to the rules laid down in page 10. Its connection with the corresponding horn of the uterus renders the diagnosis especially certain. It is often difficult, however, in such cases, to recognize the degeneration of the ovary, since moderate enlargement may also be produced by hyperplastic conditions or superimposed exudations. A very circumscribed enlargement with coarsely nodular surface favors the diagnosis of new growth; likewise a spherical shape with smooth surface and elastic consistence. The majority of these small tumors are firm to the feel, because the cysts are too small to produce an elastic consistence. Those cases are especially obscure in which peritonitic processes develop at the beginning of the growth of the tumor and deposit exudation upon the enlarged ovary. Before the termination of the inflammatory complication, and the, at least, partial absorption of the exudation, only a probable diagnosis of ovarian tumor can be made, as a rule, if other causes of perioöphoritis, especially recent gonorrhœa or previous perioöphoritis, are absent. It is not until prolonged observation has rendered the growth of the tumor certain that a positive diagnosis is possible.

In the case of larger tumors (of the size of a fist or more) which are

situated behind the uterus, the diagnosis is also based on the circumscribed character of the tumor. Elasticity of the tumor, when present, is a valuable sign, but it is generally absent at this period in proliferating cystomata. Even simple cysts and dermoid cysts are solid to the feel, especially if they fill the pelvis, and, as it were, are incarcerated. A frequent characteristic of non-adherent and readily movable tumors is their rotation upon one or more axes, a quality which belongs only to pedunculated tumors.

The position of the tumor between the rectum and uterus (which may require a rectal examination), and its pedunculation upon the fundus uteri are further requisites for diagnosis. Pedunculated insertion into the uterus speaks so much more strongly for an ovarian tumor, when the former is normal in shape and size.

When the pedunculation cannot be recognized by bimanual palpation, the pedicle can often be felt by means of Hegar's method. The uterus is drawn down with moderate force by means of Muzeux's forceps, and at the same time, we endeavor to feel the lateral borders of the uterus as far as the fundus with one or two fingers in the rectum. If this is of no avail we will generally succeed by pushing the uterus downwards and backwards, by means of the outer exploring hand. When the tumor is not too broad and large, the uterus can generally be encompassed by the fingers in the rectum, so that the connection with the latter can be recognized. When the tumor is situated above the pelvis, Hegar's method is still more successful.

This plan may be supplemented by that of B. S. Schultze, which is carried out in the following manner: An assistant shoves, with both hands, the abdominal walls as far as possible towards the symphysis, and then lifts the tumor as far as possible away from the entrance to the pelvis. Then the explorer pushes one hand beneath the tumor towards the pelvis, and endeavors to grasp the fundus uteri, which is pushed upwards by the other hand placed within the vagina or rectum. In this way the fundus can be grasped in the majority of cases, and thus the tumor may be recognized as unconnected with the uterus, and at the same time the character of the pedicle may be determined.

When the tumor is situated altogether or chiefly within the pelvis, another valuable diagnostic aid (though it cannot always be employed) consists in replacing the tumor above the superior strait of the pelvis. After this is done we can often grasp the pedicle and uterus at once, and feel the point of insertion of the former. As a general thing, rectal palpation with the half or whole hand is not more serviceable than examination with two fingers, and should always be employed with the greatest caution, in view of the reported cases of rupture of the rectum.

The relations of the tumor to the vagina vary according to its size and mobility. The smaller and more movable it is, the less broad and close

is its application to the posterior wall, while tumors, which are adherent to the floor of Douglas's *cul-de-sac*, are in broad contact with the vagina at an early period, and may even push it downwards. This is also true of non-adherent tumors which fill the pelvis and are incarcerated in it. The latter condition is apt to give rise to error, and may be mistaken for other retro-uterine tumors and retroflexion of the gravid uterus.

The employment of the uterine sound for diagnostic purposes, is necessary in very few cases. In exceptional cases it may be useful when the position of the uterus cannot be ascertained by palpation.

As a rule, great difficulty attaches to the diagnosis of those cases alone in which the tumor is adherent in the true pelvis and surrounded by exudation, or is incarcerated.

The tumors which are situated entirely within the broad ligament (generally papillomata) occupy a special position as regards diagnosis. They generally form unilateral or bilateral tumors, which are in close apposition to the uterus from the beginning or at a very early period. They are less spherical and circumscribed than other ovarian tumors, and are immovable from the start. They do not have a tense elastic feel until they have attained a certain size. Papillary formations sometimes can be felt upon the upper or lower surface, but only after they have made some advance in growth. At the start the diagnosis may be extremely difficult or impossible, and the tumors are apt to be mistaken for hæmatomata of the broad ligament. After prolonged observation the slow steady growth, and the greater distinctness of the tense elastic feel may make the diagnosis certain, especially if ascites develops, or the finely granular character of the papillomata which have perforated the wall becomes distinct.

Second Stage. The tumor has ascended from the pelvis into the abdominal cavity.—When the tumor rises out of the pelvis, the appearances change considerably. It becomes palpable externally, usually even without bimanual exploration, unless the abdominal walls are very thick. The tumor at first feels approximately spherical, and can be defined superiorly and laterally. It is usually situated in the median line, even if it is no larger than the uterus at the fourth month of pregnancy. With advancing growth the spherical shape occasionally becomes irregular, inasmuch as prominent cysts become noticeable here and there in proliferating cystomata. At a later period these may again disappear, and give place to a uniform curvature. As a general rule, the resistance is distinctly elastic, either in parts or generally. But if larger cavities have not formed in proliferating cystomata, the elastic resistance cannot be recognized, especially if the abdominal walls are thick. The tumor may have a solid or perhaps fibrous feel, even after it has extended as high as the umbilicus.

While the tumor can be clearly defined superiorly and laterally, the

lower segment disappears in the entrance to the pelvis. The larger the tumor, the more certainly it comes in contact with the abdominal walls between the umbilicus and symphysis, and produces dullness on percussion, although not over the entire surface in contact with the abdominal walls. At the periphery the intestines always resound under the percussion stroke, and the tumor cannot be demonstrated by percussion, until it extends more than half way to the umbilicus. With increasing growth, the intestines are pushed backwards and upwards, away from the anterior wall of the abdomen. At first they are still demonstrable in both inguinal regions, and at the upper border of the tumor. The tumor rapidly disappears from the pelvis as it ascends, and at the most, a small flat segment can still be reached from the vagina. In rare cases, nodular portions of proliferating cystomata project into the upper part of the pelvis, or an adherent portion of the tumor can still be palpated through the vagina.

The uterus and vagina undergo a decided change of position. As a rule, they follow the upward traction of the tumor. As in the pelvis, so in the abdominal cavity the tumor is generally situated behind the uterus. The latter is elevated, and at the same time anteverted, so that the cervix is behind the symphysis, the fundus above it and immediately behind the abdominal walls. The elevation may be so great that the entire uterus is outside of the pelvis, and if the abdomen is very pendulous, even in front of the symphysis. Under favorable conditions as regards the abdominal walls, the upper part of or the entire uterus may be felt by the external exploring hand, and its position accurately determined. It is hardly ever in the median line, often markedly deflected to one side. The elevation of the uterus naturally withdraws the cervix from the vagina to the greatest possible extent. The portio vaginalis accordingly appears small, and if it had been previously small (after the menopause) it may disappear.

The traction of the tumor on the uterus also changes the walls of the latter organ. On account of its fixation into the vagina, the uterus is sometimes elongated 4 to 6 cm. A still greater elongation, however, is the result of other causes.

Unilateral traction of the tumor may produce obliquity of the fundus uteri, but this is recognized with difficulty in the living subject. In other cases it may be drawn into a cylindrical shape.

The vagina follows the traction of the uterus. It becomes elongated and its folds disappear. The previous descent of the anterior or posterior wall may disappear. The fornix may entirely disappear as such, and the vagina be converted into a long tube with a conical extremity.

But the uterus does not always rise out of the pelvis. It may remain anteflexed in front of and beneath the tumor, especially in the virgin.

In such cases, as a rule, it cannot be felt from without, and hence the use of the sound may be of service in ascertaining the position of the organ.

In not a few cases (about one-third of the cases, in my opinion) the uterus is behind the tumor, and is then somewhat lowered, pressed against the sacro-iliac synchondrosis, and moderately retroverted, usually in the right posterior quadrant of the pelvis. In this position the greater part of the organ can often be felt through the vagina or rectum, and is readily found to be not essentially changed in shape and size. If for any reason the question of pregnancy arises, this may be much more easily excluded (usually with absolute certainty) than when the uterus is situated anteriorly and outside of the pelvis. In the retroverted position of the uterus, the vagina is relatively normal, except that its posterior wall is not infrequently somewhat lowered.

In a certain number of cases this position of the uterus is due to previous retroversion with or without fixation of the organ. But it is a striking fact that it is found much more frequently in large than in small tumors, and it is, therefore, probable that, in a certain number of cases, the ascending ovarian tumor leaves the uterus behind, and later pushes it into the concavity of the sacrum by pressure on the fundus.¹

In rare cases, but hardly ever except in very large tumors, especially when complicated with ascites, the constant increase of intra-abdominal pressure causes prolapse of the uterus and vagina. This is generally prevented by the shortness of the pedicle.

The uterus may also occupy other positions. In a few cases it assumes an almost lateral, and at the same time elevated position; somewhat more frequently it occupies an almost normal position beneath the tumor, and in the axis of the pelvis. Peaslee states that the latter position is not rare in polycystic tumors, but that he observed it only once in unilocular tumors. If, at the same time, the portio vaginalis is short, on account of elevation or senile involution of the organ, examination with the sound alone can give information concerning the direction of the uterine cavity. When the diagnosis is doubtful, this mode of examination should be employed so much the more, because this relatively normal position and direction of the portio vaginalis are found chiefly in large uterine tumors.

In almost all the cases mentioned the mobility of the uterus is greatly interfered with, if the tumor is large; when the uterus is considerably raised and anteverted, its mobility is abolished.

The displacement of the uterus in intra-ligamentary development of the tumor differs from that in most ovarian cystomata. If the tumor is unilateral, the uterus is pushed against the opposite lateral wall of the

¹ Peaslee's statement that the uterus is generally situated behind the tumor, as soon as the latter approaches the umbilicus, is opposed to the opinion of most writers.

pelvis. If the tumor is bilateral and extends considerably above the pelvis on both sides, the uterus is strongly elevated, and occasionally anteverted. The fundus may be covered by the tumor in such a way as to render palpation impossible. Characteristic of these cases is the complete immobility of the uterus.

The diagnosis of ovarian cystoma is based, in general, on the following data. The tumor can be defined superiorly and laterally, but not in the direction of the pelvis. Hence it cannot belong to the liver or spleen. If it does not extend much above the umbilicus, it may be grasped so far posteriorly by the hand, pushing in from above, that its retro-peritoneal origin may be excluded. Moreover, this is very improbable in the case of median tumors, which are largely in apposition with the abdominal walls. The tumor, therefore, must take its origin from the pelvic organs. Distension of the bladder is excluded by the use of the catheter. The genital organs alone remain. We must be able to exclude enlargement of the uterus by distension of its cavity or by a new growth. In the majority of cases this is easily done. Sometimes the unenlarged uterus is felt alongside the tumor; sometimes the nodular shape of the tumor is positive evidence against pregnancy. On the other hand, fluctuation of the entire tumor is evidence against cystic myomata; while non-cystic myomata rarely come into question. Finally, the demonstration of the pedunculation of the tumor upon the fundus of the uterus must be taken into consideration. In short the diagnosis can generally be made with certainty, almost always with great probability, by mere external and internal manual exploration.

But as the tumor increases beyond the dimensions of the uterus at full term, the diagnosis may become more difficult. The growth ascends beneath the ribs into the concavity of the diaphragm. The colon and even the stomach are no longer applied to the abdominal walls. But the great omentum often remains in front of the upper part of the tumor, although in the majority of large tumors it does not extend lower than the umbilicus. The diaphragm pushes the heart and lungs upwards. The apex beat of the heart may be felt in the fourth intercostal space and extend to the left of the mammary line, on account of the horizontal position of the organ. On the right side the diaphragm may reach the second rib. Splenic dullness has disappeared, because the spleen is situated high up beneath the diaphragm. Hepatic dullness disappears anteriorly as far as the axillary line, because the organ assumes a horizontal position. The intestines are pushed so far back that they can be demonstrated by percussion only in the loins. The previous barrel-shape of the abdomen, which resulted from the predominance of the long diameter over the transverse and antero-posterior diameters, is lost, because the tumor pushes chiefly in the direction of least resistance. The abdominal walls become more prominent, and the abdomen becomes pendulous.

The lower ribs curve outwards so that the thorax appears shorter, and a distinct boundary between it and the abdomen is lost. The ensiform cartilage is also bent outward, but this is not perceptible to the eye.

In such marked distension diagnosis is greatly interfered with by the fact that the boundaries of the tumor can no longer be felt above or to the sides. Superiorly the tumor is situated beneath the diaphragm, laterally palpation of the tumor is prevented by the thickness of the abdominal walls and their enormous tension.

Percussion now becomes especially important, while previously it had been subordinate to palpation. If we disregard the very largest tumors, the dullness on percussion, which is naturally furnished by the tumor, will be found above and on both sides, surrounded by a distinct intestinal percussion sound. Even if the tumor extends to the border of the ribs or above, intestinal or gastric percussion sound is distinct at the border of the left ribs; it is retained even longer in the triangle of the scrobiculus cordis. A clear intestinal sound is obtained in both loins, back of the middle of the crest of the ilium, while the sound is dull wherever the tumor is applied firmly to the abdominal walls, in the umbilical region, therefore, during dorsal decubitus. The area of dullness does not change perceptibly on change of position, because the large size of the tumor prevents its displacement.

Fluctuation is felt with varying distinctness in the larger cystomata, but may be absent even in the largest tumors. As a general thing, tumors which do not extend to the umbilicus do not present distinct fluctuation on external examination, but merely more or less elastic resistance. But fluctuation may sometimes be made distinct at an earlier period in tumors which can still be reached through the fornix, by pressure from the outside against the internal exploring finger.

After the tumor has passed beyond the umbilicus the distinctness of the fluctuation depends on the size of the individual cavities, the consistence of the fluid, and the condition of the abdominal walls. Even in tumors which are as large as the uterus at term, and consist essentially of a single cavity, a mere indistinct vibration, but no feeling of fluctuation may be noticed, on account of the thick consistence of the contents. Even the largest tumors present no distinct fluctuation if the individual cavities are not quite large, and the contents are not thin. When fluctuation is easily produced it is usually perceptible to the eye, although the advance of the wave is rarely as distinct as it usually is in ascites. In parovarian cysts, however, the wave of fluctuation is often as distinctly visible and as rapid as in ascites, on account of the thinness of the fluid contents and the thin walls of the tumor.

Auscultatory phenomena may also appear in ovarian tumors—for example, vascular abdominal murmurs, like those of pregnancy. But these are very rare, and possess no great diagnostic importance. We will again

refer to them and likewise to the friction murmurs which are occasionally audible.

We will here mention a sign that is noticed on palpation as well as auscultation, *viz.*, colloid creaking. This term I would apply to the murmur produced not infrequently on palpation of ovarian cysts, and which is felt even better than it is heard. It is different from the friction murmur and purring thrill of heart disease. The palpating fingers experience the sensation as if a tough mass were receding, but were obstructed by friction. It is most apt to develop when colloid matter has escaped from a tumor, and is compressed between the fingers in front of the tumor (rupture of the cysts); it is sometimes present even though the peritoneal cavity does not contain colloid matter. In my opinion it is the result of the pressure of the gelatinous mass from one cyst cavity into another, through a narrow opening. Loud creaking probably results from the consonance of adjacent loops of intestines. I regard this phenomenon as a not unimportant sign, since it not alone is evidence of an ovarian tumor, but also of its proliferating colloid character, and, finally, suggests the occurrence of rupture.

We will refer later to puncture of the tumor as an important diagnostic aid.

The mere diagnosis of a cystic ovarian tumor is not sufficient. We must also answer the following questions: What is the character of the tumor? Is it a proliferating cystoma, simple cyst, parovarian tumor, or a papilloma? Does it start from the right or left ovary or from both? Finally, Are adhesions present and what are the conditions of the pedicle?

The question of the multilocular or unilocular character of the tumor is often answered by its nodular, irregular shape. Doubt only arises when the surface is uniform, or does not contain palpable, firmer masses. We must first determine the resistance of the surface, and, if considerable differences are found, we may be certain that they result from a number of cystic cavities. Fluctuation may also be decisive. If the otherwise distinct fluctuation becomes indistinct or disappears over certain portions, we may be sure that the tumor is a proliferating cystoma. If the tumor has attained a considerable size (considerably above the umbilicus) and distinct fluctuation is not felt, it is certainly not a simple cyst. In the large majority of such cases we may safely diagnose a proliferating cystoma, even if it presents a uniform spherical surface. But the opposite inference is never justified in tumors which possess a uniformly globular surface and resistance, and equally distinct fluctuation throughout. This will not enable us to predicate the absence of small secondary cysts, which are situated within the main cyst, and give the tumor the characteristics of proliferating cystoma. Even the most distinct fluctuation of the apparently simple, not too large cyst, proves nothing against the diagnosis of proliferating cystoma, inasmuch as the colloid masses

often become approximately serous. The property of proliferating cystomata, of producing secondary cysts almost exclusively towards the interior, has often given rise to errors in diagnosis.

Hence, it is hardly ever possible to make a positive diagnosis of hydrops folliculi.

But certain unilocular tumors, *viz.*, parovarian cysts, permit a positive diagnosis in the majority of cases. The extremely distinct superficial fluctuation—which is very distinctly visible to the eye, and is produced by the slightest tap of the fingers, but which does not, as in ascites, extend beyond the area of dullness—the thin walls and flaccidity of the tumor, which often permit only indistinct palpation of its boundaries, the absence of complaints on the part of the patient, and the often demonstrable slow growth of the tumor—all these factors enable us to distinguish parovarian cysts with great certainty from proliferating cystomata. The diagnosis is so much more certain if the patient is young or the tumor has slowly returned after previous rupture. Parovarian cysts may be diagnosed in about two-thirds of the cases. In some cases the non-enlarged ovary can be felt distinctly on the side on which the pedicle of the tumor is applied to the uterus, and this makes the diagnosis certain.

We can not always tell with certainty upon which side the disease has started. If a small tumor is situated within the pelvis, and almost entirely on one side of the uterus, the question, it is true, decides itself, as it does in the case of intra-ligamentary tumors. The clinical history is entirely unreliable. A lateral position of the uterus is, to a certain extent, a positive sign, but only when it is very pronounced. The presence of loops of intestines on one side of the tumor may also lead to error, especially if they are demonstrable on the right side, where the intestinal percussion sound rarely disappears, and only in the case of very large tumors. I have had no opportunity of testing Slavjanski's sign, *viz.*, a diminution of sensibility in the inguinal region of the affected side.

As a rule, the only positive sign is the insertion of the pedicle. This is not always easily felt in large tumors. In the large majority of cases, however, it may be done with the aid of B. Schultze's manipulation, and the rectal examination of the depressed uterus.

In some cases, finally, the detection of the unenlarged ovary on one side is decisive.

It is more important to be able to determine in advance that the disease is bilateral. This can be done with more or less probability in some cases, especially if the tumors are not larger than a man's head, and are not in close contact with one another. In large tumors a deep groove between two sections proves nothing, inasmuch as certain cysts of one tumor may be distinctly isolated from the main tumor, especially if the omentum has entered the furrow and become adherent. Isolated mobility of one part is more convincing. In large tumors, however, this is

hardly ever possible on account of the diminished amount of room. The diagnosis of a bilateral affection is generally made impossible by the fact that one ovary is only in the first stage of degeneration, and is inaccessible to palpation on account of its small size. But if the slightly enlarged ovary can be felt distinctly in the pelvis, the diagnosis of bilateral disease may be occasionally made with great certainty, especially with the aid of passive movement of the large tumor, which leaves the small tumor unaffected. The diagnosis is made with the greatest certainty if the tumors are entirely intra-ligamentary.

When other circumstances testify in favor of bilateral disease, this probability is increased by the presence of amenorrhœa if the general condition is good. This permits no conclusion, however, if the body is very much emaciated. It must not be forgotten that amenorrhœa and the development of a second tumor may have an entirely different significance, *viz.*, complication with pregnancy.

I know of a case in which a pregnant uterus was, for months, looked upon as the second diseased ovary because the physician had entertained no suspicion of pregnancy on account of the social position of the unmarried patient. In a case of a very large tumor (sixty pounds) I believed, despite the presence of a deep groove, that only one ovary was diseased, because menstruation continued regularly. Ovariectomy disclosed bilateral cystomata, which were approximately equal in size.

DIAGNOSIS OF ADHESIONS.

Formerly, when a large proportion of ovariectomies were discontinued on account of parietal adhesions, the diagnosis of the latter was much more important than to-day, when we know how to treat them, and when even the most extensive of these adhesions no longer render it impossible to complete the operation.

There are cases in which extensive adhesions to the abdominal walls may be diagnosed with certainty, and others in which they may be excluded; but these cases are very rare. It is only when the tumor has not extended much beyond the umbilicus, and the abdominal walls are not very tense, that, if adhesions are absent or very circumscribed, we may move the tumor freely towards both sides, and can easily determine that it moves behind the abdominal walls, not with them. Thin and flabby abdominal walls may sometimes be raised distinctly from the tumor. On the other hand, when the tumor is moderate in size, the presence of extensive adhesions is certain if the tumor can only be moved laterally with the abdominal walls. Very thick abdominal walls usually prevent the recognition of these phenomena, and often make the diagnosis of adhesions impossible.

If simple displacement of the tumor leads to no result, the following plan is tried: The patient, in dorsal decubitus, takes a deep inspiration,

and we notice whether the upper border of the tumor moves distinctly downwards. If the tumor is very slightly or not at all adherent, this displacement may amount to 5 cm. But this phenomenon only indicates the absence of broad parietal adhesions at the upper part of the tumor. When the top of the tumor cannot be recognized by the eye, percussion must be resorted to. In very large tumors which have no intestines above them, this plan cannot be adopted. Bird introduced needles through the abdominal walls into the tumor, in order to determine, from their pendulum movements, the presence or absence of adhesions. But it is hardly worth while, at the present time, to make the diagnosis in this way.

Lee's sign, *viz.*, the passage of the tumor between the recti abdominis, and its protrusion like an abdominal hernia, is uncertain. It is said to occur, if adhesions are absent, when the patient, who has been in a recumbent position, sits up without assistance. This sign is not devoid of value if it occurs in a marked manner, but the interspace between the muscles is often absent, or the firm-walled tumor can not undergo any change of shape. In both events the sign will be absent, even if there are no adhesions.

Friction murmurs which can be felt by the hand or are audible as a creaking sound, like that of new leather, prove the absence of adhesions over the part where they are heard. But this is no evidence that the peritonitis, to which they are due, has given rise to adhesions in other parts.

Furthermore, it is known from experience that tumors which considerably exceed the size of the uterus at full term are hardly ever free from extensive parietal adhesions. In tumors of equal size, the absence of adhesions is more probable in the one which has grown more rapidly.

The clinical history must also be considered. If an acute peritonitis has occurred, especially if attended with signs of torsion of the pedicle, the presence of adhesions, and not alone parietal adhesions, may be inferred in all larger tumors, which were notably in apposition with the abdominal walls. As a rule, also, adhesions have formed wherever a circumscribed tenderness has been noticed for some time on the surface of the tumor.

Finally, coincident ascites may be a good aid in diagnosis. Considerable ascites, which separates the entire front of the tumor from the abdominal walls, is rarely found in pure cystic tumors of the ovary. As a matter of course, it would prove the absence of parietal adhesions. But the accumulation of small amounts of fluid between the tumor and abdominal walls is more frequent, especially in very large multilocular cystomata. Slight pressure of the fingers produces such a distinctly visible wave in the fluid, that we easily recognize with what we have to deal. So far as the wave is visible, there is undoubtedly no adhesion to the abdomen. But the wave is usually confined to a not very large area, whose

boundaries are very distinct, and are formed by parietal adhesions. Upon the anterior surface of a large tumor are sometimes found a number of such parts, which permit the recognition of ascitic fluid, each part being bounded by adhesions. In this way we may not alone recognize with certainty very extensive adhesions, but also those parts in which adhesions are certainly absent. The latter may be advantageous in attempting to pass between the tumor and abdominal walls during ovariectomy.

Next to parietal adhesions omental adhesions are the most frequent. They are more important than the former, because they are more difficult to treat during ovariectomy, and must be avoided during puncture. Unfortunately, however, we possess hardly any data for their diagnosis. The omentum can sometimes be felt as a soft mass in front of the tumor, and its movement may produce crepitus, but we are hardly ever able to ascertain the presence or absence of adhesions. In complicating umbilical hernia, however, I have repeatedly recognized the omentum in the hernial sac, prior to the operation, and felt the adhesion directly through the thin walls of the sac.

As a general thing, there is a probability of omental adhesions in very large tumors, or those which have a distinct intestinal percussion sound over them. Unusual gastric disturbances increase this suspicion.

The important adhesions of the viscera can hardly ever be diagnosed. According to Koeberlé, frequent irregularities in menstruation are often attended with adhesions to the abdominal organs. Occasionally they may be recognized with certainty by paracentesis, and even accurately localized, if situated on the liver or spleen. The evacuated cyst remains adherent above, as is shown by palpation and percussion. In one patient, whom I had punctured twice without being able to demonstrate a tumor in the abdomen, a cyst almost as large as the fist remained in the splenic region after the third puncture. At the subsequent operation it was found adherent to the spleen. In rare cases a small ovarian tumor is found in the upper part of the abdomen, and can not be displaced downwards. This is probably the result of adhesion to some viscus. Stahl reports a case in which the tumor had ascended with the gravid uterus, became adherent in the upper part of the abdomen, and did not follow the uterus after its evacuation.

If acute peritonitis has followed torsion of the pedicle, extensive, usually very intimate, intestinal adhesions are almost certain to result. Next in importance to intestinal adhesions are those to the pelvic organs.

The adhesion of the bladder to the tumor is not improbable if, after artificial evacuation, the catheter still passes far up and to the sides. Adhesions to other pelvic organs may be suspected if a part of the tumor extends deep into the pelvis and is immovable. Sometimes one or more prominent cysts project from the lower surface of a tumor into the pelvis. Their great mobility may be shown occasionally by lateral movements of

the tumor from above, or by partial displacement out of the pelvis, particularly in the knee-elbow position. In other cases, however the parts in question are perfectly immovable.

In many cases a positive conclusion cannot be reached. Immobility of the uterus is more frequent in subserous location of the tumors, than as the result of adhesions. On drawing the uterus down with Museux's forceps, the absence of adhesions can often be determined with certainty.

DIAGNOSIS OF THE STRUCTURE OF THE PEDICLE.

This has become much less important, since the use of the clamp has yielded to the ligature in treatment of the pedicle. In some small tumors the length of the pedicle is evident from the great mobility of the tumor. I have observed a tumor twice as large as a fist which could be pushed upwards beneath the ribs. In rare cases a long pedicle may be inferred from a complicating prolapse of the uterus. As a general thing, information is only furnished, especially in large tumors, by direct palpation of the pedicle. Although its insertion into the uterus can be felt in the majority of cases, its length cannot often be determined with certainty, because the pedicle, in its subsequent course, is often applied to the tumor or escapes the exploring hand in some other way.

It is much more important to diagnose the entire absence of a pedicle or the subserous site of the tumor.

In bilateral subserous development, especially into the broad ligaments, the diagnosis is usually made quite readily. The uterus is strongly elevated, and not infrequently somewhat anteverted, because the tumor, which grows chiefly backwards, pushes the uterus forwards. At the end of the elongated, often conical vagina, is the very short portio vaginalis, which is reached with difficulty in the most extreme cases. The direction in which the uterine sound enters shows that the uterus is situated between the tumors, which can be felt from the outside, or in the middle of the apparently single tumor. Internal exploration shows that, immediately above the fornix, the tumors are closely applied to the lateral borders of the uterus. Although these tumors usually are not large, they are situated almost entirely outside of the pelvis. But they may have developed further behind the uterus, and extend more or less into the pelvis between the vagina and rectum. The uterus is almost entirely immovable. In some cases the fundus can be felt high above the symphysis, behind the abdominal walls; in other cases it is covered by the tumors and cannot be isolated from them.

The conditions are somewhat different if there is only one tumor in the broad ligament. The uterus is usually elevated, but occasionally is pressed merely against the pelvic wall on the opposite side. In a purely lateral position the tumor also extends more deeply into the pelvis, and

its broad adhesion to the uterus may be recognized per vaginam and per rectum. Whether the tumor is unilateral or bilateral, external exploration shows diminished or abolished mobility of the tumors, which is so much more striking the smaller the growth. Even if a large tumor is situated, at its base alone, in the broad ligament, and its greater part extends free into the abdomen, the impression of a broadly fixed tumor base is created by lateral movements.

But the most characteristic feature of intra-ligamentary development is the broad approximation of the tumor to the uterus, and the ascent of this organ together with the tumor out of the pelvic cavity.

The diagnosis of the sub-serous situation of the tumor is much more difficult when its development occurs less into the broad ligament than backwards beneath the peritoneum of the floor of the pelvis towards the retro-peritoneal space. In these cases the larger part of the tumor descends into the pelvis and forces itself between the rectum and the vagina or uterus, pushing the latter forwards. The deep descent of the tumor, the entire immobility of its pelvic portion, the often partial development in the broad ligament, the papillary character of the tumor (which can usually be diagnosed from the course, the ascites, and the palpable papillary excrescences), usually render the diagnosis more or less assured in such cases.

CHAPTER XXII.

THE DIFFERENTIAL DIAGNOSIS OF CYSTOMATA.

THERE is hardly any tumor of the abdomen which has not been mistaken for an ovarian tumor. With regard to differential diagnosis, it is best to divide the tumors into two groups, *viz.*, those situated chiefly in the pelvic cavity or larger ones which extend into the abdomen.

I. DIFFERENTIAL DIAGNOSIS OF SMALLER TUMORS.

1. *Extra-peritoneal Exudations.*—In almost all cases these are easily distinguished by their immobility, their irregular shape and hardness, their sensitiveness, and the intimate manner in which they are applied to the walls of the pelvis, the vaginal fornix and the pelvic organs, and occasionally extend as flat masses to the iliac fossa.

Even if they are as large as a fist or more, they may be entirely on one side of the uterus, and whether they are situated behind or to the side of this organ, they extend so deeply into the lower part of the pelvis, that their extra-peritoneal situation is unquestionable. Moreover, the correct diagnosis is assured by the mode of development (fever and pain) and the previous occurrence of childbed in the majority of cases. Or the parametritis has been preceded by an operative procedure.

Finally, further observation shows diminution of the exudation with constantly increasing hardness.

2. *Encapsulated Peritoneal Exudations.*—In the chapter on general diagnosis, I referred to the difficulties which may arise in determining whether a degenerated ovary is present within the exudation in cases of periöophoritis with the formation of exudation. Apart from the slight exudations which may form around degenerated ovaries, peritonitic exudations, which form pelvic tumors as large as a fist, may also become encapsulated. They are situated partly to the side, partly behind the uterus, but are quite rare, apart from childbed. As in the case of parametral exudations, we must take into consideration the anamnesis, especially previous or still continuing fever, also the immobility and tenderness of the tumor, and the coincident diffuse swelling of the vaginal fornix. The diagnosis of these conditions from ovarian abscesses has been discussed in another place.

Various cases are reported in literature. Prochownik (Deutsch. med. Wschr. IX., 1883, p. 526) operated in a case of bilateral cystic tumor, as large as a fist and hen's egg respectively. Encapsulated exudations around the ovaries were found on both sides. The ovary lay in one of the abscesses "like a pistil in a flower." Dohrn (Deutsch. med. Wschr. 1879, p. 567) reports several similar cases. In a child aged four years, a cavity, which contained fluid, was encapsulated by loops of intestines and the omentum. The wall of the sac was densely infiltrated with nodules, probably tubercles. Bixby (Tr. Amer. Gyn. Soc. I. 1877, p. 326) punctured through the vagina an encapsulated exudation which simulated an ovarian tumor. Spencer Wells (Med. Clin. Trans. 65, Case 5) performed laparotomy and evacuated the abscess. The patient recovered.

3. *Pelvic Hæmatomata*.—A quite recent retro-uterine hæmatocele may fluctuate *in toto* or in parts, and may thus simulate a cystic ovarian tumor. But the non-fluctuating parts do not furnish the tense elastic or firm feel which is presented by an ovarian tumor in places at which large cavities are wanting.

The hæmatocele is soft, like a blood clot, in the places where it does not fluctuate. After a certain period, parts of the swelling rapidly become firmer, a phenomenon which does not occur in ovarian tumors. A larger hæmatocele is not apt to run its course without considerable sensitiveness, which disappears with the subsidence of the peritonitis.

As a matter of course the tumor is distinctly defined towards the vaginal fornix, but towards the sides the boundaries are diffuse. The reducibility of an ovarian tumor can only be utilized if present to a marked degree, inasmuch as a hæmatoma may sometimes be pushed up to a not inconsiderable extent. The accompanying symptoms of hæmatocele are also important. The history is that of an acute disease, with more or less violent peritonitic symptoms, vomiting, etc.; usually not without fever, often with the symptoms of acute anæmia, almost always with symptoms which prove the acute development of the pelvic tumor.

As a matter of fact, tumors have rarely been mistaken for hæmatocele. Boinet¹ alone states that he mistook hæmatoceles for ovarian cysts three times, and that the correct diagnosis was only shown by the result of puncture, which evacuated black blood.

Extra-peritoneal hæmatoma of the broad ligament is much more apt to be mistaken for a subserous ovarian cyst, than the ordinary retro-peritoneal hæmatocele. The juxtaposition of the tumor to the uterus, and the displacement of the latter, are the same in both. In recent cases a mistake is prevented by the general symptomatology, the acute anæmia, severe pains, and the tenderness of the hæmatoma. But not all cases begin with such marked phenomena. If the tumor does not come under observation until the stage of absorption, the diagnosis can often be made only after prolonged observation. In hæmatomata all the symptoms disappear after a time, and the tumor becomes smaller.

¹ Mal. des Ovaires, p. 203.

In a married woman aged twenty-three years, who had been sterile for two years, and had suffered from slight, vague symptoms, I found (Nov. 1883) firm nodular tumors (one as large as a fist, the other half as large) in both broad ligaments. The uterus, which was pushed forward, could not be sharply defined from the tumors. The latter projected strongly at the posterior surface of the ligaments. The patient was not anæmic. Menstruation was normal. Five weeks after the first examination the tumors had grown and united behind the uterus into a mass which mounted above the fundus. The diagnosis was doubtful for a long time. But gradually the tumors diminished in size, and at the end of half a year were only half as large, while the retro-uterine portion of the tumor had disappeared. This case was probably one of hæmatoma developing in several exacerbations, and which on this account did not produce any violent symptoms.

4. *Extra-uterine Pregnancies.*—Tubal pregnancy need hardly be considered inasmuch as it generally terminates very soon, and is unattended with symptoms previous to its termination. Interstitial or abdominal pregnancy in the first months is more apt to give rise to error. The fœtus cannot be felt or heard, but the fœtal sac is situated in the pelvis or it grows, in interstitial pregnancy, out of one side of the fundus uteri. The absence of menstruation, which is the rule in extra-uterine pregnancy, at least in the first months, may arouse the suspicion of pregnancy, and this may be increased by the succulence of the genital mucous membrane, and other probable and uncertain signs, but in the majority of cases it is only made certain after prolonged observation, unless the decidua is exfoliated at an earlier period.

Rothe (Cbl. f. Gyn. 1877, 18, p. 355) reports that a cancerous ovary was mistaken for extra-uterine pregnancy. Benicke (Zschr. f. Gyn. u. Gebh. IV., 1879, p. 271) reports an interesting case: the history favored pregnancy, the exploration an ovarian tumor. A tumor was felt distinctly on the posterior fornix and appeared intimately connected with the right border of the uterus; it was partly firm, partly fluctuating. The uterus was pushed forward and the fundus could be palpated separately. Its cavity measured 9.3 cm. The case was one of ovarian pregnancy, perhaps in a præformed tubo-ovarian cyst. Champonière found a lithopædion, which had been encapsulated eight years, in a case which had been diagnosed as ovarian tumor (Bull. d. l. Soc. d. Chir. 21, Nov. 1883).

5. *Tumors of the Tube.*—Hydrosalpinx, pyosalpinx and hæmatosalpinx may be mistaken for small tumors, on account of their lateral position to the fundus uteri, and their mode of connection with this organ. The ovary can rarely be felt in tubal dropsy, at least it cannot be recognized distinctly on account of the existing exudation. The retort shape or sinuosity of the tube, upon which stress is laid by many authors, cannot be recognized unless the abdominal walls are very thin. Bilateral character must arouse the suspicion of tubal disease. This may also be true of the clinical history, if there have been repeated peritonitic exacerbations, in part years before, and sterility has also lasted for years. If the tumor exceeds the size of a fist, dilatation of the tubes is, at least,

very improbable, although there are rare cases in which fifteen pounds of fluid or more were evacuated from a tubal dropsy. It is also an important feature that the latter rarely appears as an entirely circumscribed tumor, and that it is hardly ever situated in any other than the upper part of the broad ligament.

In some cases the diagnosis cannot be decided until after prolonged observation.

6. *Retroflexion of the gravid uterus* forms a tumor, particularly in the third and fourth months, which is felt in the posterior fornix as a semi-solid, spherical body. The portio vaginalis passes forward, and this may be mistaken for displacement by an ovarian tumor, situated behind it. As a general thing, the amenorrhœa, the often acute symptoms of impaction (especially the retention of urine), will direct our suspicions to retroflexion of the gravid uterus, and the thick-walled, succulent uterus will easily be recognized as such. The forward direction of the os uteri, if there is more version than flexion, is also a distinct indication, and finally, attempts at reduction, which prove the continuity of the tumor and the cervix uteri, remove all doubt. The diagnosis may be more difficult when the uterus is impacted, and, therefore, very tensely elastic, almost fluctuating, when the cervix is bent, and the os, therefore, directed downwards instead of anteriorly, when the symptoms of incarceration occur more gradually, and are not urgent, and when the amenorrhœa has given place to protracted hemorrhage. In such cases we must, above all, determine the continuity of the tumor with the cervix uteri, and ascertain by bimanual palpation whether the body of the uterus is situated between the abdominal walls and the tumor. The absence of the corpus uteri is ascertained so much more readily in retroflexio uteri gravidi, because the cervix is found immediately behind the upper part of the symphysis, and we, therefore, know exactly where the corpus uteri is to be found.

With the aid of the subjective symptoms, at the most after short observation, it will always be possible to differentiate both conditions.

II. DIFFERENTIAL DIAGNOSIS IN LARGER TUMORS.

Among tumors which no longer occupy the pelvis, or at least, only in small part, the following must be taken into consideration:

7. *Hæmatometra*.--When this occurs under ordinary conditions, it cannot be mistaken, any more than a normal uterine pregnancy, for an ovarian tumor. But in errors of development of the uterus and vagina, a unilateral hæmatometra with or without hæmatokolpos may present appearances like those of an ovarian tumor.

Several errors in diagnosis have been made.

One case is reported by Atlee. The patient, aged thirty five years, had menstruated irregularly until the eighteenth year, then regularly until the twenty-second year. At that time spasmodic abdominal pains appeared a week before each menstruation, and increased until marriage (at the age of thirty years) which was soon followed by pregnancy. The patient had a very difficult labor, which was terminated by embryotomy. For two years she remained lame in the left leg, and this never disappeared entirely. Menstruation did not return for more than two years. Then the patient discovered, above the ramus of the pubis, a tumor which soon attained twice the size of her fist. At the same time a profuse watery discharge from the vagina suddenly occurred, and nine months later a considerable hemorrhage which had been preceded by pains for weeks; dangerous hemorrhages recurred at intervals of months. There was difficulty in micturition and defecation.

Atlee found the abdomen greatly distended, and containing a tumor which extended from the symphysis to the ribs and the lumbar region. In the umbilical region, which was pointed, a small tumor, about five to six" in diameter, was situated upon the larger one. Both parts of the tumor fluctuated. Free fluid between the abdominal walls and tumor was found between the umbilicus and symphysis. The pelvis was filled by a large tumor, in which fluctuation was distinctly recognized on pressure from the outside. The uterus could not be felt in the pelvis. In the region of the left sacro-iliac synchondrosis the sound could be passed 4" above the highest point which could be reached by the finger. The pelvic tumor extended downwards so that it could be made visible between the labia majora. At the umbilicus the periphery of the abdomen measured 36", the distance between the sternum and symphysis 15".

Atlee was so much more strongly of the opinion that the tumor was ovarian because shortly before he had seen an ovarian tumor which presented entirely similar appearances. As a matter of precaution, however, vaginal puncture was first performed. The puncture slowly discharged seven pints of a thick, tarry mass; two more pints escaped through the canula in the next twenty-four hours. The large abdominal cyst was thus emptied, the small tumor was unchanged at first. In the next few days, however, it slowly became smaller and rounder, and, on examination, showed distinct contractions. On the day after the puncture Atlee found a small slit-shaped opening high up in the vagina with a very small anterior lip, while the posterior lip was continuous with the wall of the tumor. This opening he properly regarded as the *os tincae*. The sound passed 24" into the fornix alongside the *os*. On the twelfth day after the operation the patient was attacked with facial erysipelas, then stomatitis and diarrhoea, and died on the twenty-second day. The autopsy showed a uterus which was double above, the anterior half normal, the posterior half distended into a large sac. The separation began in the region of the internal *os* which must have been occluded. The ovaries were normal.

Although the statements concerning the anatomical relations are very incomplete, it may be assumed as certain that the large cyst was the distended second vagina, and the smaller one the uterus. Otherwise the tumor would not have descended so far into the pelvis, while the other horn of the uterus was situated so high above the pelvis, that it could not be reached. This case happened in 1851. The more recently reported cases would have enabled us to make a correct diagnosis, although the age of the patient and the clinical history would hardly be of any assist-

ance. The following would have been the diagnostic points: the deep descent of the fluctuating tumor (especially in a tumor with a main cyst), the extremely elongated vagina and the inaccessibility of the os uteri. Contractions of the tumor may perhaps be produced, in similar cases, prior to puncture, and these facilitate the diagnosis, as Braxton Hicks¹ showed with regard to the diagnosis of pregnancy. Difficulty was experienced in this case, however, from the enormous dimensions of the tumor, which are almost unheard of in hæmatometra and hæmatokolpos.

In 1875 Staude² published a second case.

The patient, aged thirty-two years, had menstruated regularly since her thirteenth year. She had four children, the last four years ago. Two years ago, after the fall of a heavy weight upon the abdomen, a tumor appeared in the right side of the abdomen, and grew quite rapidly, at first without pain. Pains in the back subsequently appeared, and were often intensified during the menses, but were not dependent on them.

Exploration revealed a tumor occupying more than the right side of the abdomen; it was roundish, but the upper part was narrower as if the tumor consisted of two parts. It extended 24 cm. above the symphysis. Over the tumor the percussion sound was dull, around it tympanitic. On the left side of the larger tumor was found a smaller movable one, which was shown to be the uterus on combined exploration: the portio vag. could only be reached with the half hand. The sound entered the latter for 8 cm. The vagina is wide, and along its right side is a tumor which fluctuates with the outer one. Rectal exploration showed that the tumor must be chiefly adherent in the right side of the pelvis.

After the diagnosis of ovarian tumor was made, laparotomy was performed, and the walls were at once perceived to be of striking thickness. Puncture with Spencer Wells' trocar evacuated two large basinfuls of sanguinolent fluid but the walls did not collapse. The tumor was then drawn forward and the real condition recognized. The vagina was then perforated from the cavity, and the first opening and the abdominal walls were carefully closed.

The patient recovered after slight complications, but died of another disease six months later. The autopsy showed double uterus, and the vagina was also double down to the middle.

In this case, also, the clinical history and age of the patient were of no assistance. The conditions were not unlike those of Atlee's case, but the uterus was more distended and formed the crown of the main tumor, not merely an appendage. The form of unilateral hæmatometra may vary greatly, and as in Atlee's case the uterus formed an appendage of the distended vagina, in others this is true of the dilated tubes, and perhaps a multilocular cystoma may thus be simulated. An especially important diagnostic feature is the marked elevation of the uterus, and the, in the main, lateral position of the tumor; but this also happens in intra-ligamentary ovarian tumors. Hence, the condition is more apt to be mistaken for the latter variety of tumor. Another important feature

¹ Trans. Lond. Obst. Soc., XIII., p. 216.

² Zschr. f. Gebh. u. Frauenkhn., I., p. 138.

is the marked descent into the vagina of the hæmatokolpos, whose intimate connection with the pelvic walls was recognized in both cases. But if the uterus alone is double, this sign will be absent. If the youthful age and the clinical history do not lead to a correct opinion, the diagnosis of ovarian cyst will be apt to be made, on account of the rare occurrence of unilateral hæmatometra. Säger¹ has reported a third case. In a married woman, aged twenty-four years, who had been childless for four years, and had menstruated at the age of seventeen years, menstruation gradually became scanty and very painful. To the right of the uterus was found a solid, smooth, painless tumor, as large as a lemon, which was connected with the uterus by a pedicle. It was regarded as a solid tumor of the right ovary, and extirpated, the pedicle being tied with silk. The walls of the tumor were found to be muscular, and it and the pedicle were filled with tarry blood. There was a passage into the tube from the cavity of the tumor. The normal ovary was also situated on the tumor. The walls of the latter were 1 cm. in thickness.

8. *Distension of the bladder* has been repeatedly mistaken for and treated as an ovarian tumor. The mistake can only be made, if, after protracted ischuria, the urine dribbles spontaneously, the distended bladder runs over. The latter forms a median, comparatively narrow, but very prominent tumor, which cannot be felt from the vagina, or only indistinctly. It pushes the uterus backwards. It must also be remembered that, after prolonged ischuria, the walls of the bladder may be thickened, so that the organ creates the impression of a solid tumor. Mistakes cannot be made if the catheter is employed.

Literature of Mistakes.—Spencer Wells was present when puncture was to be performed on account of ovarian tumor. He was struck by the shape and position of the tumor. The catheter was introduced and the tumor disappeared. Gooch reports that in a case of pregnancy the supposed ovarian tumor was punctured, the perforation passing through the bladder and uterus into the head of the fetus. In a case of uterine fibromata Aran punctured the distended bladder, which he mistook for an ovarian tumor. Scanzoni reports the following: the patient, who suffered from cancer of the uterus, presented a tumor as large as a man's head, on the left side, which was regarded as an ovarian tumor. This tumor, the bladder, burst suddenly and disappeared during a vaginal exploration. Hewitt observed a non-elastic, hard tumor, which had existed for three weeks, and had been regarded as ovarian. It disappeared after catheterization. Liéven reports the following: for five years the patient suffered from abdominal symptoms, the result of a tumor rising out of the pelvis. The abdomen was as large as in the sixth month of pregnancy. Preparations for ovariectomy were made, but catheterization was first performed, and 4000 cubic cm. of urine evacuated. The tumor was in the urine glass. Atlee mentions that in an ordinary case of retroflexio uteri gravidi, with retention of urine, he cured the ovarian tumor, which had been diagnosed by two physicians, with the catheter.

9. *Fæcal tumors* may resemble real tumors, and the diagnosis may be

¹ Deutsch. Med. Wschr., 1879, 17.

rendered difficult by existing diarrhœa. As a general thing, they would be more apt to be mistaken for cancer of the peritoneum on account of the nodular character, the tenderness of the tumor and the entire abdomen, and the spontaneous pains. Boinet has reported a case, however, in which the patient was treated for two years for ovarian tumor, and Scanzoni acknowledges that, in an osteomalacic woman whose abdomen was as large as in the later stages of pregnancy, he had mistaken the distended intestines, during a single hurried examination, for an ovarian tumor.

Apart from the symptoms, which very often consist of colicky pains, occasionally of digestive disturbances, such as nausea, vomiting, etc., the chief points in diagnosis are the nodular shape of the tumors, their mobility, and their ability to retain the impressions of the fingers.

10. *Tympanites and Pseudotumors*.—It is well known that, in hysteria, there are forms of tympanites which may simulate tumors, on account of contractions of the abdominal muscles, perhaps sometimes of the intestines. Percussion quickly proves the absence of a tumor. In 1823, prior to the employment of percussion, Lizars, in the first operation of the kind which was to be performed in Great Britain, made an incision through the entire length of the abdomen, without finding a tumor. J. Y. Simpson mentions six similar cases. Atlee reports that a tumor, which was regarded as a double ovarian tumor, appeared to be situated above Poupart's ligament, and with its long axis parallel to that ligament. Preparations for operation had been made, when Atlee showed by percussion that no tumor was present. He assumed an atrophy of the abdominal muscles which gave rise to the protrusion. Boinet reports the history of an hysterical woman, upon whom several physicians were persuaded to perform laparotomy, although the absence of a tumor had long been recognized by other physicians.

In one case Krukenberg (Arch. f. Gyn. XXIII., 1884, p. 139) attributed the phantom tumor to lordosis of the lumbar vertebræ. This may result from paresis of the dorsal extensors or general muscular weakness in exhausted individuals (convalescents). The muscles actually become shorter in time from approximation of the terminal points.

Percussion and the observation of the other hysterical symptoms, which are rarely absent, will usually decide the point at once. If necessary, the examination may be made during narcosis.

The diagnosis may be more difficult, if an œdematous condition of the abdominal walls, or an unusually thick panniculus adiposus, interferes with the examination. The percussion sound may then be dull to a certain extent, and even a vibration of the abdominal walls, which is very similar to fluctuation, may appear upon palpation with the fingers. But the thickness of the abdominal walls is easily recognized and calls for the exercise of caution. The examination should be made while the patient

is breathing deeply and regularly, the fingers being pressed in as far as possible at the height of expiration. Or great resistance of the abdominal walls is overcome, according to Spiegelberg's recommendation, by strong counter-pressure for a few minutes with the tips of the fingers of both hands. Furthermore, we should particularly examine the parts above Poupart's ligaments, where the panniculus is less developed; the pleximeter and hammer should be employed rather than the hand, in order to secure more vigorous percussion; finally, narcosis should not be neglected. Under such circumstances the diagnosis of a tumor, which is not really present, cannot be made.

Atlee also mentions some cases of error in regard to conditions of this kind. The most peculiar one occurred in a woman, aged sixty years, who had such a marked elephantiac hypertrophy of the abdominal walls, that she could lie only on the side and could not turn in bed without assistance. While sitting she placed the immense abdomen upon a chair standing in front of her, and which it entirely filled. The measurement around the waist was 45", around the abdomen 92", from one anterior superior spinous process of the ilium to the other 64", from the umbilicus to the symphysis 43". The patient's weight was 455 pounds.

Unfortunately, in this case as in the others mentioned by Atlee, corroboration by autopsy, that they were really instances of excessive development of the panniculus adiposus, is wanting.

A very unusual case in all respects is reported by Reeves Jackson:¹ an enormous dilatation of the stomach was mistaken for ascites or ovarian tumor. Puncture discharged a dark fluid with *débris* of food. Laparotomy (!) was then performed, and the tumor, which was regarded as a cystic myoma, was incised. The patient lived until the next day. I have been unable to ascertain whether this case is identical with that reported by Detroit.² Litten³ observed a case in which the abdomen was greatly distended by fluid, and fluctuated throughout. A fluctuating tumor could be felt per vaginam. On autopsy it was found to be the stomach, distended by an enormous amount of fluid.

11. *Solid Fibromyomata of the Uterus*—the cystic tumors will be discussed separately—have often been mistaken for ovarian cystomata, and this mistake may be made in both directions.

Ovarian cysts, which do not pass above the umbilicus, often contain no large cavities or perhaps only jelly-like masses, and for both reasons may present a firm consistence throughout. They are apt to be regarded as fibromyomata, if they are so closely applied to the uterus, as to seem to form a single mass. The mistake is favored by thickness of the abdominal walls and diminished mobility of the tumor.

A positive diagnosis can only be made from the examination, not from

¹ Ctbl. f. Gyn., 1880, No. 15.

² Lancet, Jan., 1880.

³ Ztschr. f. Klin. Med., II.

the previous history. The resistance is tested by the tips of the fingers of both hands, which are applied at points of the tumor as diametrically opposite as possible, and with which short, pushing movements are executed. The real resistance of the tumor is ascertained much more certainly in this way than by ordinary palpation.

But the most important feature in each case is to determine the relations of the tumor and the body of the uterus, *i.e.*, the pedunculation into a horn of the uterus, or the broad-based transition of the tumor into the uterus, with the aid of the previously mentioned method of examination of the pedicle.

A certain value also attaches to the demonstration of a considerable elongation of the uterine cavity, which favors the diagnosis of uterine tumor. Nothing is proved, however, by an elongation of merely a few centimetres.

Report of mistakes:

I experienced the following case: A woman, aged fifty-two years, claimed that a tumor in her abdomen had appeared only a week before. I found a very nodular tumor, as large as a man's head, above the symphysis in the median line, and which had a solid feel through the thick abdominal walls. The os uteri, which was almost destitute of a portio vaginalis, was situated high up behind the symphysis. Through the posterior fornix could be felt a solid, slightly nodular tumor, which seemed to pass directly into the uterus. On account of the elevation of the os and the absence of the portio vaginalis, the mobility of the organ could not be determined by introducing the hand into the vagina. The sound was introduced, without difficulty, 3" into the senile uterus, and apparently into the middle of the tumor. The diagnosis of multiple fibromata was proven false at the end of two months. The tumor had become much larger, and, with the exception of the pelvic portion, was elastic throughout. The patient remained under observation for a long time. While the abdominal walls were thick, the mistake resulted chiefly from the use of the sound, and could probably have been avoided by more careful bimanual exploration. I have made a similar mistake in two other cases. Lehmann also regarded an ordinary ovarian cystoma as a uterine myoma with ascites, chiefly for the reason that the sound passed 28 cm. into the uterus. *Post-mortem* the uterus was found to be only 7 cm. long, but the right tube was very much dilated. The sound had passed into the latter.

The opposite mistake of confounding a myoma for an ovarian cyst occurs chiefly when the abdominal walls are very fat and permit a solid tumor to appear elastic. Here the previously mentioned pushing movement, with the tips of the fingers of both hands, possesses considerable value. Numerous mistakes have been reported:

W. Atlee reports no fewer than six cases in which the diagnosis of

ovarian tumor, instead of myoma uteri, was falsely made, either temporarily or permanently. Some cases are very instructive.

In a patient, aged thirty-three years, laparotomy was performed and revealed the error. The mistake was chiefly owing to the fact that the sound, which was introduced to the normal depth into the cavity of the uterus, hardly took part in the movements of the tumor. The sound subsequently entered further, after it had overcome a resistance like that experienced in the rupture of adhesions. The manner in which the introduction of the sound had led astray was then made manifest. The tumor was a broad-based, submucous fibroma, which had considerably shortened the cavity. On the first occasion the sound had entered the right tube, and had not taken a corresponding part in the movements of the uterus, because only a small part of the instrument was situated in that organ. On the second occasion the sound had undoubtedly entered the degenerated tissue of the uterus and appeared to be situated between the uterus and tumor.

In the second case the diagnosis was based on the apparent absence of connection between the tumor and uterus upon moving both parts. Extirpation was successful. The tumor then proved to be a pedunculated fibroma. The autopsy, which was made a few years later, showed that the ovaries were normal.

In case 72, the elastic character of the uniformly smooth tumor, which was as large as the uterus in the eighth month of pregnancy and was situated entirely above the pelvis, and the narrow cervix had led to the mistaken diagnosis of ovarian tumor. But Atlee introduced the sound 9½" and felt its lip through the abdominal wall of the tumor above the umbilicus. It took part freely in all the movements of the uterus, and it thus became evident that the case was one of intramural fibroma of the anterior wall of the uterus.

Lizars, Granville, Stilling, Spencer Wells and Peaslee also extirpated, usually with fatal termination, solid uterine fibromata which had been mistaken for ovarian tumors. In Köberlé's first eight cases of extirpation of uterine myomata, three cases were mistaken for ovarian cysts.

In very large tumors we must also take into special consideration:

12. *Pregnancy*.—An error of diagnosis under ordinary conditions is inconceivable. It has only occurred more frequently when hydramnion developed during pregnancy. The uterus may then fluctuate as distinctly as an ovarian cyst. At the same time the certain signs of pregnancy, i.e., those dependent on the foetus, are discovered with difficulty, often not at all in a single examination. The foetus cannot be felt, and the heart sounds are inaudible. So much greater importance then attaches to those signs which render pregnancy merely probable, such as the changes in the breasts, the succulence of the portio vaginalis, the uterine bruit. When all are present, pregnancy becomes highly probable, but not certain, and in such cases we must attempt to discover an absolutely certain symptom. As such I recommend the production of foetal movements, and their perception by means of auscultation. The tumor should be palpated vigorously, and as generally as possible, and auscultation performed immediately afterwards. We then hear foetal movements which could not have been felt by the hand. This is almost always the best method of attaining certainty in a doubtful case of pregnancy, even at

an early period. The phenomenon can almost always be produced even as early as the fourth month, a period when the fœtus can rarely be felt, and the heart sounds are never audible.

When certainty is unattainable in this way, we should chiefly employ that method of examination which always possesses a great value, and, apart from the signs of pregnancy, the greatest value as a means of distinguishing uterine from ovarian tumors,—we refer to the demonstration by bimanual palpation, that the portio vaginalis passes directly into the lower part of the tumor, or that, on the contrary, the uterus is situated alongside the tumor. Even if, in very many cases, the entire uterus cannot be felt alongside the tumor, it is sufficient to recognize that the lower part of the corpus does not take part in the tumor. Braxton Hicks' sign,¹ the production of contractions of the pregnant uterus by palpation, is also available for diagnosis.

As a matter of course, the sound may not be employed when there is a suspicion of pregnancy. But it must be clearly remembered that the emptiness of the uterus, and, therefore, the absence of pregnancy, cannot be proven, as is so often believed, by the ease with which the sound is introduced into the uterus. Numerous reported cases prove that the pregnant uterus may be easily sounded, without giving rise to a suspicion of pregnancy. The number of unpublished cases of this kind is naturally much larger. Every busy gynecologist must have met with the experience that, without thinking of pregnancy, he introduced a sound into the uterus, and at the same time must have learned that this does not suffice either to make or exclude the diagnosis of pregnancy.

With regard to menstruation, *i.e.*, to its regular occurrence, I must remark that I attach to it a much greater diagnostic importance than the majority of other writers. I have never met with a case in which menstruation occurred at regular intervals in the second half of pregnancy, nor even during the fourth month. When we may rely upon the statements of the patient, I regard regular menstruation as an almost positive proof against pregnancy in the second half. Irregular protracted hemorrhages prove nothing, inasmuch as they may occur during pregnancy, and may even continue for months, as the result of separation of the ovum and other complications. The difficulty of the diagnosis in individual cases is evident from the fact that, in one case of ovarian cyst, Scanzoni was unable to convince himself for weeks of the absence of pregnancy.

Literature of Mistakes:—Tavignot² punctured a pregnant uterus, which was mistaken for an ovarian tumor. This was followed by abortion and death. Blundell mentions a similar case. In Aran's case puncture was only prevented by the occurrence of delivery. Pollock³

¹ Trans. Lond. Obst. Soc., XIII., p. 216.

² Mém. sur l'Hydropisie de l'ovaire, Expérience, 1840, No. 160, p. 55.

³ Med. Times and Gaz., 1862, p. 277.

had the misfortune to perform laparotomy in a case of pregnancy; Boinet prevented it in a similar case. Edis mistook a monolocular ovarian cyst for the pregnant uterus, and at another time, the pregnant uterus for an ovarian tumor. Deceived by the very distinct fluctuation, I also made a diagnosis of ovarian tumor, in a case of marked hydramnion. Irregular hemorrhages were present, and unfortunately prevented the suspicion of pregnancy from arising. But the chief source of error, as in the majority of other cases, was the hurried examination. Laparotomy was performed and the diagnosis was evident as soon as the peritoneum was opened. On account of severe dyspnoea, labor was induced by puncture of the membranes. The patient recovered rapidly.

Fortunately the majority of mistakes were made in the opposite direction, *i.e.*, ovarian tumors were mistaken for pregnancy, usually upon the statement of the patient that she felt the movements of the child.

13. *Ascites* is the most important affection to be considered in differential diagnosis. In no other respect do mistakes occur so frequently in the diagnosis of ovarian tumors. The larger the ovarian tumor, and the more distinctly and generally it fluctuates, the more readily is the mistake made. As a general thing, the differences between both conditions are very striking: in ovarian tumor the abdomen is barrel-shaped, higher than it is broad, in ascites it is spherical and larger over the groins. In dorsal decubitus the flattened shape becomes more evident in ascites, and the flanks become more prominent. Decubitus on one or the other side at once flattens the ascitic abdomen in the diameter from the right side to the left; in ovarian cysts the shape remains unchanged. The lower ribs are not deflected outwards in ascites. In ovarian tumor the largest periphery of the abdomen, in dorsal decubitus, is almost always below the umbilicus, in ascites it is at or above the umbilicus. In ovarian tumor the distance of the umbilicus from the symphysis is greater than that from the umbilicus to the ensiform cartilage; in ascites both distances are approximately equal. Edema of the lower limbs or general anasarca is very frequent in ascites. In ovarian tumors the former hardly ever occurs unless the abdomen is extremely distended, and general anasarca practically does not occur except in complicating renal disease. Organic heart disease favors the diagnosis of ascites. Cirrhosis of the liver, when the cause of ascites, is usually not discovered until after puncture. Very acute development of the abdominal swelling, accompanied by fever, favors ascites, other things being equal. The condition of the pelvic organs is also important. A very movable uterus is never found in tumor, and always speaks for ascites. This is also true of descensus uteri, though with more numerous exceptions. This results, together with depression of the posterior fornix, from the pressure of the ascitic fluid; it is extremely rare in ovarian tumor. Knowsley Thornton states that, in ascites, the portio vaginalis is often shortened like a button. This phe-

nomenon probably results from depression of the fornix, without coincident descent of the uterus.

The diagnosis of ascites is also favored by fluctuation produced upon the slightest contact with the fingers, and which, at the same time, is so superficial that the eye detects even the smallest waves, and can follow their extension to the loins. In ascites the fluctuation also extends beyond the region of dullness, because it is propagated between the loops of intestines.

But all these signs may be poorly defined, and when the size of the abdomen is very large, its shape is especially apt to be a source of doubt. Accompanying cedema or complicating diseases may be absent. The previous history may be indefinite, and very distinct, superficial fluctuation also occurs in unilocular ovarian tumors

If the tumor is not very large, we must be able to feel its contours, while the feeling of having a tumor under the fingers is always absent in ascites, however slight.

Percussion almost always furnishes decisive results in difficult cases. In ascites, during dorsal decubitus, a tympanitic sound is heard above a certain horizontal boundary; below this there is dullness, because the intestines float on the water. If the ascites is not very marked, the sound is tympanitic in the scrobic. cordis, and more or less towards the umbilicus, while it is dull in the loins; the boundary of dullness is found between the umbilicus and each loin. If the ascites is marked and dorsal decubitus complete, a region immediately above the umbilicus, and including the latter, is the highest part of the abdomen, and intestinal percussion can only be heard in this locality, while there is dullness over the ribs and scrobiculus cordis, because these are situated lower. The conditions are reversed in ovarian tumors, in which there is dullness at the middle of the anterior abdominal wall at its highest parts, but a tympanitic sound is heard over the lower arches of the ribs, still more certainly in the scrobic. cordis, and longest in the loins, because the loops of intestines are pushed into these regions. In ovarian tumors the boundary between the tympanitic and dull areas is convex towards the latter, in ascites *vice-versâ*.

The varying conditions on changes of position are especially important. A large ovarian tumor can no longer undergo displacement, and the changes in position do not affect the results of percussion. But in ascites, in which the intestines always strive to reach the surface of the fluid, the lower side is dull in lateral decubitus, and the upper side is always tympanitic. The change in the level of the fluid becomes especially distinct if the patient is first examined in dorsal decubitus, and then in the erect position.

We cannot recommend too strongly this mode of percussion with change of position, even in cases which appear to be undoubted ovarian

tumors, partly because ascites often simulates ovarian tumor, partly because both are often associated and the ascites may be overlooked. But it is necessary that the patient be placed first on one side, then on the other. I observed a case in which evident ascites was regarded as an ovarian tumor by a very experienced colleague, simply because he had examined in left lateral decubitus alone. The highest part of the abdomen was absolutely dull. This was owing to the enormous liver, which could not be felt before the removal of the ascites. Other tumors floating in ascites may give rise to similar errors, and hence examination by percussion should always be thorough.

However positively, in the majority of cases, this will furnish immediate and certain information as to the presence of free fluid or a cystic tumor, there are nevertheless numerous sources of error, which increase with the amount of fluid or the size of the tumor. Mistakes are possible even in very moderate ascites. They are chiefly owing to the fact that parts of the intestine with an absent or short mesentery (such as the descending colon or cæcum) produce a distinct tympanitic sound in the dependent portions of the abdomen, if the fingers are pressed deeply into the abdominal walls. In moderate distension of the abdomen, therefore, we must be careful that the fingers or pleximeter are merely applied, and not pressed in. Every marked difference, which results from the firmer pressure of the fingers against the abdominal walls, testifies decidedly in favor of the presence of free fluid. This condition may lead the beginner to diagnose an ovarian tumor in moderate ascites, because loops of intestines may be percussed even far back in the loins. But this mistake is readily avoided. It must also be remembered that an ovarian tumor can always be palpated, and its boundaries felt with the hand, in moderate distension of the abdomen.

It is much more difficult to avoid mistakes when the abdomen is very markedly distended. The difficulties reside in the following facts: In very large ovarian tumors every trace of tympanitic sound disappears from the region of the scrobic. cordis, and below the left ribs. The dullness furnished by the tumor is in immediate contact with pulmonary resonance. Hence, the percussion conditions in the loins are alone decisive. Even here the tympanitic sound may disappear entirely, or its area may be so small that percussion no longer furnishes any certainty. The loops of intestines may be compressed into such a small space next to the spine that they can no longer be percussed, especially on the side of the diseased ovary, on account of the kidneys and the thick muscular coat of the intestines, or the latter are filled temporarily with feces, and the condition is thus rendered more complex. The conditions on percussion become unusually similar to those of ascites after air has entered an ovarian cyst. Every change of position then changes, as a matter of course, the relative position of the air and fluid.

In ascites, on the other hand, the tympanitic sound at the highest part of the abdomen may be wanting, if, on account of the enormous distension of the abdomen, the mesentery is not long enough to permit the intestines to float. This is especially apt to take place when the mesentery has been shortened by processes of retraction (chronic peritonitis) or the development of malignant tumors. Hence it is particularly in the ascites of peritoneal tuberculosis or carcinosis, that the diagnosis of ovarian tumor has been erroneously made, even when the amount of fluid was moderate. In such cases the peritoneal adhesions are often so extensive and numerous, that cystic formations with distinct boundaries occur between the loops of intestines (so-called *hydrops saccatus*).

On the other hand, the gut may sometimes be percussed in the dependent parts in marked ascites, partly when the intestines, which are fixed posteriorly on account of the absence of the mesentery, are strongly distended, partly when there are abnormal adhesions of the intestines to the abdominal walls. Here all changes in percussion on change of position may be absent. In order to recognize, in ascites, loops of intestines which do not extend to the abdominal walls, but are in the vicinity of the latter, we should not fail to perform deep percussion over the middle of the abdomen.

As a matter of fact, the diagnosis may be extremely difficult, and even the aid of all the other symptoms mentioned, such as the mode of fluctuation, the shape of the abdomen, etc., may fail us, inasmuch as the differences in these respects are effaced more and more when the tension of the abdominal walls is extreme. In intricate cases, the difference of percussion, according as the pleximeter is loosely applied or pressed deeply into the abdominal walls, has appeared to me to be the most certain of all the symptoms.

Exploratory puncture remains in those cases in which other means of examination are exhausted. It affords the double advantage of permitting an examination of the character of the fluid, and of more careful palpation of the emptier abdomen.

There is no doubt that both may be of the highest importance, and may afford the desired information. The advantages of examination of the fluid have been extolled particularly by Waldeyer and Spiegelberg. Its greatest significance obtains in the two conditions in question.

On page 75 I have discussed the occurrence of paralbumin, which must be regarded as a mixture or combination of albuminoids and mucin, and have explained how, according to Huppert, this substance may be demonstrated. Whether it is an absolute proof against the presence of purely ascitic fluid, is very questionable, inasmuch as the germinal epithelium on the surface of the ovary must be regarded as capable of producing this substance. But whenever mucin (paralbumin) can be demonstrated directly or indirectly from the formation of sugar by means of the action

of acids, it may be assumed in all probability that ascites is not alone present. Characteristic of the latter, according to Spiegelberg, is the spontaneous coagulation which usually occurs in ascitic fluid when allowed to stand, but never in ovarian fluid. But even this sign is not reliable. Klob, Martin, Westphalen and Scanzoni have observed spontaneous coagulation of the contents of ovarian cysts. In a case of ovarian cyst with torsion of the pedicle, Schroeder was led astray by the spontaneous formation of clots, and this also happened to me in a case which will be described under the head of cystofibromata (see page 162).

But Spiegelberg and Waldeyer attach the chief importance to the microscopical examination of the fluid. Ascitic fluid regularly contains amœboid cells, plate shaped endothelium, often blood and pigment, but never cylindrical epithelium. The latter, on the other hand, is characteristic of ovarian fluids. The latter also contain blood corpuscles and pigment, often cholestearin, more rarely pus corpuscles; but the latter are not present exclusively, as Spiegelberg claims, in inflammation of the cyst-wall. These signs are undoubtedly of great importance. Whether the presence of cylindrical epithelium always testifies against its ascitic origin, must be decided by further investigations. The superficial epithelium of the ovary may enter the ascitic fluid so readily, that we cannot accept as absolutely convincing the conclusions (based on twenty-five cases) of even such an accurate observer as Waldeyer. At all events, it must be remarked that in parovarian cysts, which are still inseparable from ovarian cysts, the microscope not infrequently fails us entirely, because we are often unable to find any morphological elements in the fluid, apart from granules and cell nuclei. This is probably also true of the fluid of dropsical follicles.

Hence, the examination of the fluid usually suffices to remove the doubts of diagnosis, but does not absolutely exclude the possibility of error.

If too little fluid has not been removed, palpation after puncture may permit further important conclusions. If the fluid was ascitic, a solid tumor may then become palpable, a large liver may appear, the pedicle of the tumor or its connection with an abdominal viscus may become evident.

The differences between ascites and ovarian cysts may be summarized as follows:

OVARIAN CYSTS.

Slow growth and increase of symptoms.

Edema of the legs rare and late.
Hardly ever general anasarca.

ASCITES.

Rapid development, sometimes with fever. Cardiac, hepatic or renal affections occasionally demonstrable.

Early œdema of the lower limbs or even general anasarca.

OVARIAN CYSTS.

Abdomen barrel-shaped, ribs everted. Largest diameter antero-posteriorly. Greatest circumference below the umbilicus.

Change of position without influence on shape of abdomen (exception: very flabby—parovarian—cysts, especially after puncture.)

Early dullness on percussion at highest part of abdomen (umbilicus); resonance persists longest in scrobic. cord. and loins.

Percussion unaffected by change of position; (exception: very flabby cysts).

Wave of fluctuation confined to area of dullness.

Uterus often elevated or retroverted towards concavity of sacrum, otherwise relatively normal position; mobility impaired.

Fluid more or less thick, contains mucin; almost all shades of color; sp. gr. 1015—1050, hardly ever spontaneous coagulation. Contains epithelial, cylindrical cells, often cholestearin, more rarely pus corpuscles.

As a matter of course the complication of an ovarian cyst with ascites increases the difficulties. Fortunately very large tumors are attended by very little or no ascites, and ignorance of this complication is not followed by bad results, as the ovarian tumor forms the principal disease. The condition is different when a small tumor is surrounded by ascites, a phenomenon found chiefly in solid ovarian tumors and proliferating cystoma, more rarely in glandular cystomata. In the latter case the condition, strictly speaking, is not really ascites. As a rule, fluid of an ovarian, not of an ascitic character, has entered the abdominal cavity as the result of rupture. This phenomenon is observed in papillary cysts, in which papillæ have developed on the outer surface. In all such cases, at first, the diagnosis of ascites alone can be made. Puncture may clear up the condition, if we can recognize the ovarian character of the fluid or palpate the now recognized tumor.

Literature of the Mistakes:—This is extremely large. It may be assumed that half or more than half of all so-called exploratory punctures have been performed in ascites. Careful analysis of the conditions which have given rise to error would be extremely instructive. The majority of

ASCITES.

Abdomen spherical; ribs in normal position. In dorsal decubitus, abdomen broader than high. Largest circumference at umbilicus.

Change of shape of abdomen on change of position.

Tympanitic sound at highest part in dorsal decubitus, especially on deep percussions. Dullness earliest in the loins.

Change of position causes tympanitic sound at the highest part of abdomen.

Wave of fluctuation extremely distinct, easily produced, and extending into tympanitic region.

Uterus often descended, even prolapsed; unusually movable.

Fluid thin, light yellow or green, occasionally tinged with blood; sp. gr. 1005—1024 (rarely over 1015). Frequent coagulation after long standing. Contains white blood globules, perhaps never epithelial cells.

the cases, however, have probably not been published or discussed in detail. I will content myself with the reports of a few cases:

Atlee mentions two cases of ovarian air-containing cysts, which might have simulated ascites. In both, tympanitic percussion sound was present at the highest part of the abdomen, in every position. One patient had been punctured fourteen times, the last time six days before. The symptoms could be explained, even without the assumption of air in the cysts, from the flaccidity of the latter. The next puncture furnished purely ovarian fluid. In the second case perforation into the intestine had occurred shortly before. The size of the abdomen soon became normal, after profuse evacuations through the rectum.

Litten¹ made a diagnosis of ascites in a flabby, monocular ovarian tumor, being led astray by the changes in percussion on assuming lateral decubitus. Henoch describes a similar case.

A more serious and unfortunately more frequent mistake is that of regarding ascites as an ovarian tumor.

The following is Atlee's instructive case: The patient, aged forty-nine years, mother of six children, suffered for three years from attacks of pain at intervals of months, later more frequently. Menstruation recently remained absent at two periods, but has reappeared. After a severe attack of pain six weeks ago, the abdomen began to swell, and in two days was as large as at full term. It fluctuated throughout, and retained the same shape in all positions. Dullness on percussion, except along the right side and in the umbilical and epigastric regions. This is unaffected by change of position. Twelve pints of a greenish yellow fluid are removed with the trocar. The latter entered and was removed with difficulty. On all sides of the puncture opening for a distance of 3", was felt a mass like a folded cyst-wall; there were also hard nodules in the epigastrium and to the left of the umbilicus. The uterus was immovable in the pelvis. About six weeks later the patient died in a condition of extreme emaciation, after having recovered from an attack of volvulus.

The autopsy showed that the peritoneal cavity was like a simple cyst. The intestines were fixed to the spine by the markedly shortened mesentery. The tumor at the umbilicus had been formed by the omentum which was retracted into a hard mass. The visceral and parietal peritoneum was infiltrated with tubercular nodules.

The factors which might have led astray in this case were the absence of influence of change of position on the shape of the abdomen, and the conditions on percussion. But the unequal distribution of tympanitic percussion on the two sides was inconceivable in an ovarian tumor, and the tympanitic percussion at the umbilicus was hardly compatible with such a tumor. The palpable nodules, the tumor at the umbilicus, and

¹ Zschr. f. Klin. Med. II., 3.

the absolute fixation of the uterus after the puncture, were extremely suspicious.

Atlee also reports the following case of complication of ovarian cyst with ascites: Patient aged forty years, sterile. Abdomen large for years. Then violent attack of abdominal pain, followed by distinct accumulation of fluid. At the same time swelling of the feet. Menses regular but painful. Puncture four times. After each puncture a large, firm, uneven mass remained in abdomen. Atlee saw the patient sixteen days after last puncture. The enormous abdomen was symmetrical, dullness on percussion throughout. Fluctuation extremely distinct, and a feel as if the fluid were thin. A tumor could be felt on suddenly pressing the tips of the fingers deep in. Change of position does not affect the shape of abdomen and percussion. Uterus in normal position and apparently unconnected with tumor. After another puncture the tumor was felt to be cystic; the diagnosis of ovarian cyst and ascites was made, and confirmed by laparotomy. The diagnosis was only rendered possible by the puncture.

The conditions appeared to point to simple ovarian cyst. The tumor had pushed all the intestines backwards, and thus concealed the physical signs of ascites, while the latter had obscured all traces of the tumor.

Spencer Wells mentions two cases of chronic peritonitis, in which he made the diagnosis of ovarian tumor, and the condition was only cleared up after the incision. In the first case a tumor appeared to move behind the abdominal walls on deep inspiration; both loins were tympanitic in dorsal decubitus. On these accounts the first diagnosis of free fluid was overthrown. Puncture afforded no positive information. Laparotomy showed that the size of the uterus and ovaries was normal; only a few loops of intestines were freely movable; the majority, together with the colon and the omentum, were fixed posteriorly and superiorly in the abdomen. The peritoneum was covered with thousands of tubercles. The patient not alone recovered from the exploratory incision, but the fluid did not reaccumulate, and she was alive at the end of ten years. McDowell and Henry Smith made similar mistakes. In a case of ascites Peruzzi was also induced to make a diagnosis of ovarian tumor, by the tympanitic percussion over the right loin and right ileo-costal line. Laparotomy was unattended by bad results. Edis was led astray in a similar manner in a case of malignant tumor of the omentum and ascites. Gosselin injected iodine in a case of ascites, without bad results. Such a mistake, however, would generally prove fatal. West also injected iodine into the peritoneum; death from collapse occurred at the end of sixteen and a half hours.

14. *Cystic Fibromata of the Uterus or Broad Ligaments.*—The differential diagnosis from these tumors is extremely difficult. Mistakes would be very frequent, were it not for the fact that cysto-fibromata are very

rare. As a rule, very large tumors alone give rise to a mistake. This is owing to the fact that these large tumors may be exactly like ovarian cysts in shape, resistance, displacement of the intestines and the results of percussion.

The differential data are few, and the majority are uncertain. On the whole cysto-fibromata do not develop at a very early age. Heer found that among fifty-one patients with fibro-cystoma of the uterus, eight came under observation between the ages of twenty and thirty years, seventeen between thirty and forty years, twenty-three between forty and fifty years, and three between fifty and fifty-three years. The subjective symptoms will hardly aid the diagnosis. Hemorrhages are generally absent in cysto-fibromata, as they are usually sub-peritoneal. They are not elastic throughout; firm parts are found between softer parts. As the walls of the cysts are thick and muscular, they may present a doughy feel when the abdominal walls are thin. Fluctuation is usually indistinct. Considerable elongation of the cavity of the uterus, distension of the cervix and vascular murmurs, favor the diagnosis of uterine tumor. The surface of cysto-fibromata presents very slight or no irregularities. The most important sign is the demonstration of the direct and broad origin of the tumor from the uterus. This can often not be ascertained by vaginal examination, so that rectal exploration is of the greatest importance. Distinct pedunculation of the tumor at the site of insertion of a tube will favor its ovarian origin, but not with certainty, inasmuch as cysto-fibromata also are often pedunculated. In such an event a mistake can hardly be avoided, but is of no particular moment, inasmuch as the removal of the cysto-fibroma is also desirable.

Finally, puncture may decide the question. The trocar introduced into a cysto-fibroma meets with much greater resistance in penetrating the wall. A large amount of fluid is rarely discharged, sometimes only blood, otherwise either a serous, cloudy, yellow fluid, or a dirty brown, even chocolate-like mass; never the tough, jelly-like or mucoid masses of most ovarian cysts. The fluid often coagulates entirely or in part at the end of a few minutes or hours. The coagulation has been regarded as a certain indication of a uterine tumor, and in one case I saw it occur forthwith. But it takes place in the minority of cases alone, so that its absence does not disprove the diagnosis of uterine tumor. On the other hand, certain ovarian tumors present the same phenomenon. These are rarely cysts, but usually solid tumors containing larger cysts (cysto-sarcoma). In them the cavities possess, in part, the same genesis and significance as in uterine cysto-fibroma (dilated lymphatic spaces) or the fluid, which is a simple transudation from the blood, has retained the tendency of the latter to spontaneous coagulation. I have observed this phenomenon in the following case of ovarian tumor:

Mrs. K., aged fifty-three years at the time of her death, was treated by me twelve to fourteen years previously for retroflexion, with frequent and violent peritonitic attacks. After the lapse of years I saw her again. A smooth solid tumor, as large as a child's head, was felt over the left half of the entrance to the pelvis. The uterus was elevated above the pelvis, the long-standing retroflexion had disappeared. From the physical character of the tumor I regarded it as an uterine fibroma. After one or two years a similar solid tumor had formed above the right half of the superior strait, then both tumors merged into one and slowly continued to grow. After a long interval I found that elastic soft spots could be felt in the tumor, which had attained the size of the uterus at an advanced stage of pregnancy. The elastic tension increased and the soft spots continued to grow. Finally, the tumor formed a mass, which, although smooth and round on the whole, presented three large flat elevations. These formed by far the greatest part of the tumor and fluctuated distinctly. But the wall was evidently thick and rigid, so that the fluctuation was not as distinct as in certain ovarian cysts.

My diagnosis of ovarian cyst was strengthened, and an exploratory puncture with Pravaz's syringe was made in two places. The result was a faintly cloudy, thin, light yellow fluid, which coagulated completely at once. The clot did not express any serum subsequently. This decided the diagnosis in favor of cystic myoma, and I repeatedly remarked in the clinic that, without puncture, it would have been mistaken by every one for an ovarian tumor. Puncture was again performed with a large trocar to relieve the patient's sufferings towards the close of life. Twenty-two pounds of fluid with a sp. gr. of 1016 were removed.

The autopsy revealed an ovarian tumor, which should be regarded as solid although it contained numerous fissures throughout. It was a cystosarcoma, whose cavities contained large old fibrinous clots, which formed thick deposits on the irregular walls, and yellow serum. Numerous fresh masses of blood, chiefly coagulated, were also found. The tumor weighed about twenty-five pounds.

In Schroeder's case coagulation resulted from hemorrhage following torsion of the pedicle. This is perhaps the only way in which ovarian cysts can acquire fluid, which will coagulate spontaneously.

But although an absolutely reliable differential diagnostic sign is not present, we can sometimes attain a certain degree of probability by taking all the symptoms into consideration. Spontaneous coagulation of the fluid remains the best of all the probable signs.

We will mention only a few of the numerous cases of error: Holmes extirpated the uterus and tumor, after recognizing his mistake. The patient died. Routh mistook a cysto-fibroma, which had grown rapidly in seventeen months, for the ovary. Extirpation was impossible. The patient died. Neugebauer mistook a uterine cystomyoma, which grew between the layers of the broad ligaments, for an ovarian tumor. Ascites was also present. The tumor and uterus were extirpated. Fatal termination. Lee based his diagnosis chiefly on sounding the uterus, which was only $2\frac{1}{2}$ " long, and appeared to be movable, apart from the tumor. The patient died thirty-one hours after operation. The uterus was 7" long. Rossen extirpated a cystic myoma in the broad ligament; after its enucleation a pedicle, 5 cm. thick, was found connecting it with the uterus. 500 gr. of fluid had been evacuated. The lateral situation of the tumor and the fact that the body of the uterus could be felt in great part under normal conditions, had

led to the mistaken diagnosis of ovarian cyst. Numerous cases have also been reported by other writers.

Gayet mistook a cystic myoma of the broad ligament for an ovarian cyst. Grube made a similar mistake in a case of fibro-cystic sarcoma of the Fallopian tube. Schetelig describes a cystomyoma telangiectodes cavernosum of the broad ligament which resembled an ovarian tumor.

15. *The renal tumors* which have been mistaken most frequently for ovarian tumors are hydronephroses, next echinococci and cancers. In the majority of cases there are sufficient differential data, especially the origin of the tumor from the region of the kidney, its fixation in this place and its slight mobility, the situation of the intestines between it and the abdominal walls, finally the fact that the tumor can be grasped above the symphysis from below. But if the renal tumor becomes very large, these differences disappear more or less. The tumor fills the abdomen, and its lateral origin is hardly recognizable. Its immobility proves nothing, since this is also characteristic of large ovarian tumors. The intestines may finally be pushed entirely or in great part from the abdominal walls and to one side.

The following features must be considered in very large renal tumors; a distinctly asymmetrical position of the tumor, a certain space being left free on one side of the abdomen. The condition of the intestines, when situated otherwise than is usual in ovarian tumors, is also of the greatest importance. Spencer Wells first showed that the colon of the same side is situated in front of hydronephroses. In left hydronephrosis the descending colon is usually in front, in right hydronephrosis the ascending colon is in front and to the inner side. Only horse-shoe and floating kidneys could be situated in front of the colon, but the former rarely undergo dropsical enlargement. Ovarian tumors are never situated behind the ascending or descending colon, and the transverse colon and small intestines are rarely situated in front of an ovarian tumor.

If intestines can be percussed in front of a doubtful tumor, and tympanitic resonance is absent in the lumbar region, the tumor is not ovarian. But in very large ovarian tumors percussion often fails us in so far as the compressed ascending or descending colon or both are not necessarily demonstrable by percussion.

If the colon in front of an hydronephrosis is empty of air, it can be demonstrated by the injection of water into the intestines. The water readily extends to the ileo-cæcal valve, but does not enter the small intestines. Welsh has also recommended that the intestine be made recognizable by blowing in air. The injection of effervescent mixtures or of waters rich in carbonic acid is perhaps still better. Simon believes that this will not prove successful unless the tumor is partly evacuated by puncture. Otherwise the air will not enter the compressed gut, or it will escape above.

The descending colon can alone be felt by the introduction of elastic tubes, inasmuch, as Simon showed, the sounds never pass beyond the sigmoid flexure. In some cases, finally, the empty gut can be felt as a band in front of the tumor, but cannot be recognized as the large intestine. The intestine can be made to contract by a rolling movement, and is then felt as a distinct band (Spencer Wells).

It is also advisable to make the examination a few hours after dinner, or to auscult the intestinal murmurs. In Esmarch's case of a very large tumor, a strip of tympanitic percussion 4 cm. wide was situated above the symphysis. This was shown by laparotomy to be due to the descending colon, which was situated transversely in front of the hydronephrosis. In Fränkel's bilateral hydronephrosis a tympanitic percussion sound was heard above each Poupart's ligament. But the position of the intestines alone is never decisive, since they may also be situated in front of ovarian tumors. It is necessary to be able to recognize the large intestine.

The anamnesis is also important. If this indicates the development of the tumor in childhood, and its slow growth, an ovarian cyst is as improbable as a renal tumor is probable; since hydronephrosis and renal cancer are especially frequent during childhood. Thus, Esmarch's patient is said to have been born with a large abdomen; in Wells's case of hydronephrosis the abdomen had been large for twelve years. One case of renal cancer, which had been mistaken for an ovarian cyst, occurred in a child of four years. In Cooper-Rose's case the tumor dated back fifteen years, *i.e.*, it began at the age of thirteen years. Hydronephroses often appear to grow rapidly at the period of puberty and during pregnancy. The clinical history may also direct attention to anomalies in the urinary excretion—hæmaturia, presence of pus—and to an examination of the urine, which may reveal disease of the kidney, perhaps even carcinoma. But even in the latter disease the urine may be normal if the ureter of the diseased side is occluded, and the healthy kidney alone excretes urine.

Mobility is not an absolute sign against renal tumor. Simon states that the base of an hydronephrosis is always immovable, but that the anterior part may present a certain mobility during lateral decubitus. According to this author, the abdominal walls are then drawn in by the traction of the tumor, at the point where the peritoneal covering of the latter is inserted into the anterior abdominal wall. During this change of position, intestines can never push their way between the spine and the point of retraction of the abdominal walls. This is conceivable in ovarian cysts, but does not occur in the case of large tumors.

Free mobility of the uterus is a not unimportant sign against ovarian tumor.

The greatest importance must be attached to manual rectal palpation. While one hand palpates the tumor from the outside, the other half or

whole hand in the rectum determines the relations of the lower part of the tumor to the pelvic organs. This plan is so much more decisive in hydronephroses, because the latter, if at all large, extend into the entrance to the pelvis, while, on the other hand, they do not fill the pelvis so completely as tumors of the sexual organs, and, therefore, permit palpation to be made more readily. In Fränkel's case it was found, on rectal exploration, that both ovaries could be felt alongside the tumor, and that the lower part of the latter was separated on all sides from the fundus uteri. Still more important is the recognition, especially when the uterus is drawn down, of the presence or absence of a pedunculated connection between the tumor and uterus. Schroeder's opinion that the portion of the pelvic peritoneum, which forms part of the covering of a large hydronephrosis, may simulate the passage of a pedicle to the tumor, does not appear to be based on actual observation.

Finally, exploratory puncture remains, but we will be loath to resort to it when the question of hydronephrosis arises, inasmuch as it is quite dangerous in this condition. In a number of cases puncture was always followed by severe reaction. The contents were always a thin fluid. In echinococcus of the kidney, puncture would be still more dangerous, and should never be performed if there is a suspicion of this disease.

The exploratory puncture is decisive if abundant urea is demonstrable in the evacuated fluid, or if the latter contains undoubted cylindrical epithelium. But this is often not the case. The colloid character of the fluid is not decisive. Billroth relied upon the colloid character of the evacuated fluid, in which characteristic formed elements could not be found, and extirpated the tumor which was only recognized as hydronephrosis towards the close of the operation. The chemical composition of the fluid in hydronephrosis is so inconstant, that urea may be entirely absent, while it sometimes contains mucin and paralbumin. On the other hand, urea has been found repeatedly in ovarian fluids. Exploratory puncture has thus led repeatedly to the erroneous diagnosis of ovarian cyst. It also induced Schroeder to desist from a laparotomy, which was really indicated. Danforth, led astray by the microscopical examination, —he found Drysdale's "ovarian cells,"—extirpated a hydronephrosis for an ovarian tumor. It will be well, in future, to examine also for other urinary constituents, and especially to make the murexide test. Uric acid has not been found hitherto in ovarian fluids.

G. Simon proposes to combine exploratory puncture with sounding of the cyst. In order to avoid the entrance of air, it should be done by pushing long metallic sounds through the canula, while the fluid is escaping. It is intended to show in which direction the cyst mainly extends. In how far this proposal is practicable, can only be shown by experience.

As the tumor diminishes in size during the evacuation, we must ascertain the side towards which the cyst retracts.

If the cyst is incised the palpation of its inner surface will prove the presence of renal dropsy by the demonstration of the renal calices. According to Simon, "these are characterized in small cysts by strongly projecting ridges, in large cysts by shallow, round or semilunar depressions, which are lined by mucous membrane and bounded by projecting edges. The depressions are quite round, and, have a diameter of $1\frac{1}{2}$ to 2 cm. or more; the entrance is narrower than the base. They are situated on the posterior wall of the cyst, at intervals of 3 to 4 cm."

Taken all in all, the clinical history, the lateral position of the tumor, its fixation, the position of the intestines, the mobility of the uterus, furnish sufficient data to rouse our suspicions. When this has been done, we can generally succeed in making a diagnosis with the aid of urinary examination, rectal palpation, and, if necessary, exploratory puncture. We doubt, however, whether the diagnosis can be made in all cases.

Among thirteen hydronephroses in the female, on which operations were performed, the correct diagnosis was only made three times. Morris states that among twelve non-intermittent hydronephroses in women, seven were regarded as ovarian tumors. A study of the recent cases shows that one or another sign was present in almost every instance, which might have made the diagnosis of renal tumor possible; for example, in Billroth's case, the markedly lateral position of the large tumor, which extended to the fornix; in Loebker's case the height of the tumor above the pelvis, and the absence of connection with the pelvic organs; in Rosenberger's case the strip of tympanitic percussion running transversely across the left-sided tumor.

The opposite error is very rare. Boinet alone mentions that he extirpated two ovarian tumors, which had been regarded by others as renal tumors, and that he saw a third case on autopsy. Furthermore, in Schroeder's case, mentioned above, the correct diagnosis of ovarian tumor, which was originally made, was abandoned for that of renal dropsy.

16. *Other retro-peritoneal tumors* are recognized, on the whole, by the same factors as renal tumors. The lateral position alone may be wanting. Malignant tumors, echinococci, and cysts of the pancreas are the most frequent. It is evident that rectal exploration is of special importance, and perhaps it alone may be capable of clearing up the diagnosis. As a rule, malignant tumors are complicated with ascites, which interferes with the diagnosis, if parts of the firm tumor can be palpated through it.

Cases: Smith's case of echinococcus, which he regarded as an ovarian tumor, appeared to be retro-peritoneal. The following case referred to by Virchow is unique: Spencer Wells extirpated a retro-peritoneal tumor which contained twelve and one half pints of pus. The originally firm tumor was a cystoid, which was very similar to soft myoma or myosarcoma of the uterus. Virchow termed it a fibroma molluscum cysticum abdominale.

The following rare case was observed by K. v. Rokitsky: the circumference of the patient's abdomen was 114 cm. The tumor extended two handbreadths above the umbilicus, filled the entire abdomen and presented slow fluctuation. No hard parts could be felt. Laparotomy showed that the transverse colon was intimately adherent to the lower, anterior surface of the tumor, which contained brownish-red fluid with crumbly masses. The portion free from adhesions was removed with the *écraseur*. Death from peritonitis in ten days. The autopsy showed that the cyst started from the tail of the pancreas. On injection of the pancreatic duct the injection mass appeared in the cyst wall, in which pancreatic parenchyma could also be demonstrated. The inner surface of the cyst presented cylindrical epithelium and papillary excrescences.

I have also mistaken a cyst of the pancreas for a parovarian cyst. The patient, aged forty-nine years, had noticed increased size of the abdomen for one year; menstruation regular. The greatest circumference of the abdomen, which felt elastic throughout, was 123 cm. The boundaries of a thin-walled tumor could be felt indistinctly; it extended a handbreadth above the navel and about one and one half handbreadth on each side of the linea alba. In this region there was dullness on percussion, beyond it the abdomen was tympanitic. Exploration was interfered with by thick abdominal walls and elevation of the uterus. Puncture was performed with Potain's apparatus, and thirteen and one half pounds of a cloudy, light reddish brown fluid, with a specific gravity of 1004.5, were evacuated. It contained a large amount of albumen, no formed elements except compound granular corpuscles.

The diagnosis of parovarian cyst appeared to be most probable. The cyst re-filled in great part in seven weeks, and laparotomy was then performed. The cyst, which was punctured after exposure, then discharged a fluid which looked like milk or lymph, and the root of the cyst led towards the middle of the lumbar spine. I then abandoned extirpation, stitched the sac into the abdominal wound, and drained externally. The patient died on the fourth day with symptoms of collapse and increasing frequency of the pulse; highest temperature, 38.2°; sepsis or thymol poisoning (the sac had been irrigated repeatedly with thymol). Autopsy showed that the cyst was connected with the pancreas. Direct connection with the lymphatics could not be proven by injection through the thoracic duct.

17. *Tumors of the liver and spleen* are very rarely a source of error. As a rule, the characteristic shape of large tumors of the spleen, the oblique position in the abdomen, the general condition and the usually very evident leukæmia will guard us against error, even if the tumor extends into the pelvis.

Serous cysts of the spleen, which are extremely rare, will hardly attain a sufficient size to simulate an ovarian tumor. Echinococci, on the other hand, have repeatedly given rise to error.

Taignot punctured a splenic tumor, 35 cm. in length, which he mistook for an ovarian cystoma; not a drop of fluid escaped. The autopsy showed that the tumor was situated in the spleen. Ikawitz mistook a splenic cyst with twenty-two pounds fluid contents, for an ovarian tumor. The patient died of hemorrhage thirty-six hours after attempted extirpation. The fluid contained a good deal of albumin, no paralbumin or formed elements.

Péan extirpated successfully an enormous spleen, which he had regarded as a multilocular ovarian cyst. More than twenty similar cases are reported. In one case, on the other hand, Recamier, Boulland and Jobert mistook an ovarian tumor for an echinococcus of the spleen.

Hepatic tumors are rarely so large as to be mistaken for ovarian cysts. This occurs most frequently in echinococci, more rarely in cancer. But even in such cases we can demonstrate the connection of the tumor with the liver, or at least, with the right hypochondriac region, while it possesses no connections with the genital organs. White and Bryant extirpated echinococci hepatis, which they mistook for ovarian tumors. Andral, on the other hand, mentions a case in which an ovarian tumor was regarded as an enlargement of the left lobe of the liver.

Atlee reports three cases in which hepatic cysts were found instead of ovarian tumors. Bixby describes a case of hepatic cyst, from which five pints of yellowish brown fluid were removed by aspiration. This contained an enormous amount of cholestearin, and pressure on the tumor gave rise to a murmur like emphysematous crackling.

The difficulty which may attend the diagnosis of large echinococci is shown by my case, reported in Kuthe's dissertation:

Mrs. B., aged thirty years; abdomen large for past two years; was first taken sick with chill and pains in epigastrium, and remained abed four weeks. In the last year menstruation had repeatedly ceased for months. In May, 1878, the abdomen was much larger than at end of pregnancy. It was spherical; on the right side below the umbilicus was a flattening as large as a hand, which appeared suspicious to me, inasmuch as I never had seen a similar condition in ovarian tumors. The boundaries of a tumor seemed to be recognizable in the scrobic. cordis; its walls appeared to be very thin. The abdomen was painless, elastic, without any hard parts; vagina totally prolapsed. Uterine cavity 11 cm. long. Laparotomy on May 10th, 1878. As soon as the tumor was exposed, the striped echinococcus membrane was recognized. Around the incision the sac was adherent to the abdominal walls. The echinococcus was incised only as far as it was exposed, to avoid opening the peritoneum. Hundreds of vesicles were discharged; weight twenty-five pounds. After evacuation of the sac I passed two fingers through it to the lower surface of the liver, where I found a round opening, 6 cm. in diameter, which communicated with a smaller cavity in the parenchyma of the liver. The patient recovered and was still healthy at the end of seven years.

It need hardly be said that rectal exploration during the existence of the prolapsus uteri, would have shown the absence of connection between the tumor and uterus. But it was thought sufficient to make a vaginal examination after reduction of the prolapse, and the lower surface of the tumor was not reached in this way.

18. Finally, *peritoneal tumors* must be taken into consideration, viz.,

malignant tumors of the omentum and mesentery, cystic tumors, especially of the omentum, and so-called hydrods saccatus peritonei, *i.e.*, encapsulated inflammatory products in the peritoneum. Finally, free echinococci are found in the abdominal cavity.

Cancer of the peritoneum is the most frequent of these conditions, and quite a considerable number of mistaken diagnoses have been reported. The error results almost always from the accompanying ascites, through which the cancer nodules are felt, and the impression of a multilocular ovarian cyst is thus produced. The ascites is inflammatory and attended by numerous adhesions of the intestines to one another and to the abdominal walls; retractions of the mesentery may also interfere with free movements of the intestines. Both conditions affect percussion, so that inferior parts may be dull and superior parts tympanitic. Very little can be said in general concerning the avoidance of such mistakes. It should not be forgotten that, if the abdomen is not very large, the distinct boundaries of an ovarian tumor must be palpable, and not merely the few firm nodules, which are generally felt in cases of cancer of the peritoneum. On careful examination suspicion will often be excited by the superficial character and distinctness of the fluctuation. This is particularly true of percussion if it does not furnish results which clearly favor the diagnosis of ovarian tumor, *i.e.*, absolute dullness above the symphysis upwards and backwards to a certain fixed boundary, and tympanitic resonance beyond this region. When tympanitis and dullness are present in an irregular, inexplicable manner, and when considerable changes occur on changes of position, the probabilities are in favor of ascites with adherent loops of intestines.

Attention must also be paid to the often very distinct mobility of the firm nodules of cancer within the accumulation of fluid, to the not infrequent rapid course of the morbid symptoms, the exhaustion and the usually advanced age of the patient.

The difficulty of the situation is shown by the case in which Luecke diagnosed an ovarian tumor, despite previous puncture. The patient aged forty-three years, presented dullness on percussion above the symphysis, to half way between the navel and xiphoid process. Tympanitic percussion laterally; umbilicus effaced. After evacuation of twenty-three pints of cloudy yellowish fluid through a trocar, a movable tumor, which was regarded as an ovarian cyst, was felt distinctly on the left side. A month later laparotomy was performed; after the escape of the free fluid a malignant tumor was found, and the wound closed. Death followed shortly afterwards, and a retro-peritoneal cancer, starting from the pancreas, was found. The tumor which had been felt was the bursa omentalis filled with a large amount of fluid. The following features might have led to a correct diagnosis in this case: the rapid development of the tumor, the spontaneous pains and tenderness on pressure, rapid emaciation, and hard

nodules which had been felt behind the uterus, and proved to be cancerous masses.

Cases of so-called *hydrops saccatus* also belong, in part, to this category, but it usually is found without malignant new formations. The variation in the cases is, if possible, even greater, inasmuch as the serous or purulent accumulations may be found in the pelvis, mesentery, omentum, anterior abdominal wall, upon the iliac fossæ.

Atlee's case will serve as an illustration. A woman, aged thirty-two years, noticed, after an attack of severe pain, a tumor in the lower, middle part of the abdomen. Puncture, at the end of several months, discharged four and one half gallons of sticky, light green fluid, and a firm, tender tumor was then felt on the right side. Violent inflammation followed. Second puncture a month later; two and one half gallons fluid. A tumor now felt in each inguinal region, the right-sided one firm and slightly movable, the left-sided one softer and immovable. Soon afterwards Atlee found the abdomen symmetrical and much larger than at full term. Distinct fluctuation everywhere; characteristic signs of a non free accumulation of fluid; hard masses in the tumor; uterus fixed. Subsequent puncture discharged thirty pints straw-colored, cloudy fluid. No distinct tympanitic sound discovered, but the right-sided tumor was felt to dip into the fluid. Before removing the trocar the tumor on the left side was punctured and discharged two pints of the same fluid which had been present in the abdominal cavity. The uterus had become more movable, but the pelvis was still filled up. The fluids had a sp. gr. of 1013 and 1015; that from the cyst contained very much fibrinogenous substance. The latter was therefore supposed to be a peritoneal cyst, the right-sided tumor a multilocular ovarian cyst. Three weeks later Atlee performed laparotomy. After two gallons of peritoneal fluid had been discharged, both tumors and the uterus were found surrounded by a common membrane. This extended to the abdominal walls in such a manner that a pocket was formed above the symphysis, extending from one ilium to the other. A sound in the uterus could be easily felt through the membrane. After the tumor on the right side was found to be cystic, both tumors were punctured. The wall of the right tumor presented papillary excrescences here and there. The membrane was so adherent that extirpation was abandoned.

The papillary excrescences were found to consist of rows of vesicle-like structures, which were regarded as the result of inflammatory irritation of the peritoneum. Death at the end of three days. The autopsy showed thickening and roughening of the parietal peritoneum, with papillary growths in places. The pelvic organs were essentially normal, but adherent to one another; chronic inflammation of right ovary, some atrophy of left ovary. A number of subperitoneal cysts on right side of uterus; some had suppurated. The cysts were partly smooth, partly papillary. The floor of the main cavity was formed by Douglas's sac, and all the changes were the result of chronic peritonitis. The absence of tympanitic percussion sound was owing to the fact that the intestines were drawn against the spinal column.

West mentions a case in which the omentum contained four to five quarts of fluid. An ovarian tumor had been diagnosed during life.

In Buckner's case, an ovarian tumor was diagnosed, and an abdominal incision 9" long was made. The tumor lay between the folds of the mesentery, surrounded by loops of intestines. It was excised and the superior mesenteric artery tied, in

addition to other vessels. The patient recovered, although the mesentery had been separated in great part from the intestines.

The recent literature contains not a small number of cases of omental and mesenteric tumors which had been regarded as ovarian. Carter operated on an omental cyst, with fatal termination. Werth reported a cyst of the mesentery of the ileum. In this case both ovaries could be felt, the cyst was freely movable towards the upper part of the abdomen, and a band of mesentery passed to the tumor from above—signs which should be considered hereafter, and which, although they did not render possible the diagnosis of the form of tumor in Werth's case, at least testified against its ovarian origin.

Madelung reports a large lipoma myxomatodes of the mesentery, which was looked upon as an ovarian tumor and extirpated. The œdematous character of the tumor simulated fluctuation and its large size (longest diameter 38 cm., weight 17500 grm.) prevented the recognition of its relations to adjacent organs. Waldeyer reported a somewhat similar case in which a lipomyxoma, weighing sixty-three pounds, was found at the root of the mesentery.

Spencer Wells removed part of a fatty tumor (twenty pounds) which appeared to start from the mesentery. At the autopsy the remainder of the tumor was found to weigh twelve pounds. It enclosed the right kidney; the ascending colon was pushed to the left. Wells mentions a similar case observed by Cooper Foster. The weight of this partly fibrous lipoma was fifty-four pounds. I also observed a tumor as large as a child's head, which I mistook for an ovarian cyst. A nodular segment, as large as a fist, extended into the pelvis behind the uterus. The latter could not be drawn down, the ovaries and pedicle could not be felt. The operation revealed an adherent tumor, weighing ten and a half pounds, which probably started from the mesentery. It was firmly adherent to a loop of small intestines, and had attacked a part of the intestinal wall as large as a "mark" piece. The extirpation of the tumor was combined with resection of the intestine. The patient died seven months later from cicatricial stenosis of the gut.

It is still more difficult to diagnose echinococci which are situated in the omentum, mesentery, or free in the abdominal cavity. The latter are not infrequently multiple, because they result from the rupture of a mother vesicle, and the abdomen may assume enormous dimensions. The diagnosis is generally impossible unless we can detect the hydatid thrill or follow the development of the tumor, for example from an hepatic echinococcus, or are put on the right track by the presence of echinococci in other organs. Our suspicions may also be aroused by the often slow growth of the tumor, violent attacks of pain, and the strikingly nodular character of the tumor. An extremely interesting case of multilocular

echinococcus of the abdominal cavity is reported by Spencer Wells. The abdomen presented the same appearances as in multilocular ovarian cyst, and fluctuated very distinctly. A number of hard nodules, which felt like cancer nodules, were scattered in the abdominal wall, and intestinal cancer might have been suspected, had not the disease lasted twelve years. On puncture the nodules were found to be echinococci. Wells operated later, and evacuated three to four pounds of echinococci, from the size of a pea to that of an apple, which were situated in great part on the omentum and mesentery.

Geissel and Scheerenberg mistook multiple echinococci of the abdomen for ovarian cysts, and performed laparotomy with fatal termination. In Witzel's and Slavjansky's cases the connection of the tumor with the genital organs could be excluded, on account of the high position of the tumor in the abdomen. Thornton successfully extirpated an echinococcus during pregnancy. It was situated to the right side and in front of the uterus, had grown very rapidly, and was movable towards the uterus.

The diagnosis is especially difficult, if both tumors co-exist. During an ovariectomy Freund found an echinococcus, which had ruptured into the ovarian tumor.

In two cases I mistook abdominal echinococci for ovarian tumors, and operated. In both cases the tumors were as large as the uterus in the fifth month of pregnancy. One was situated in the right hypogastric region, extending a little to the left of the linea alba, but a few nodules reached nearly to the border of the liver. The tumor was exquisitely nodular, tense, elastic, and a number of small apparently solid nodules extended into the pelvis. Its connection with the uterus could not be determined. The uterus was strongly displaced to the right side and retroverted. Per vaginam the tumor could only be felt above the left fornix.

In the second case the abdomen had increased in size for five years. The patient had suffered much from pain. The tumor had a smooth surface, and was tense elastic. The uterus was displaced to the right and retroverted. The tumor, with the uterus, was somewhat movable. A band-like structure could be felt running from the uterus to the anterior wall of the uterus, where it disappeared. Both patients survived the extirpation and recovered.

Several mistakes have also been made in cases of tumors of the abdominal walls. If they extend very far back, so that they cannot be grasped posteriorly between the fingers, they may simulate intraperitoneal tumors which are adherent to the abdominal walls. Weinlechner extirpated a cysto-fibroma of the abdominal walls, weighing 8400 grm., which he mistook for an ovarian tumor; Rokitsansky had a similar experience in a case of fibroma weighing 17 kilo.

CHAPTER XXIII.

DIAGNOSTIC PUNCTURE AND INCISION.

THE diagnostic object of puncture may be effected in two ways, by examination of the fluid obtained and by palpation after puncture. The latter presupposes the evacuation of considerable fluid, while small amounts may suffice to determine the character of the fluid. We may employ, according to circumstances, either a small canula or a large trocar, which will even admit colloid fluids. We can rarely use a canula and syringe as small as those of Pravaz's syringe. It is best to employ a thicker canula with a carefully fitting syringe, or Dieulafoy's aspirator. If colloid fluid is suspected, it is better to use a thick trocar. If a solid tumor is suspected behind a layer of fluid and at not too great a distance from the abdominal walls, we may slowly pass through the abdominal walls in the linea alba with a lancet, and as soon as they are perforated, introduce a canula alongside the lancet.

As a general thing, the dangers of exploratory puncture are so much less the thinner the canula. But, on the one hand, we cannot always choose very thin canulae, and on the other hand, the calibre of the instrument does not cause such a great difference in the ensuing dangers, as to render it proper to freely puncture any abdominal tumor, if the trocar is sufficiently fine. In a number of cases, however, the intestines have been punctured on account of tympanites and the bladder on account of the impossibility of catheterization, without any bad results.

The dangers consist of the possibility of the escape of fluid into the abdominal cavity, and of the entrance of air into the tumor, which may be followed by suppuration or gangrene. Or a solid tumor may be injured, so that blood or tissue elements may enter the abdominal cavity, and there lead to inflammation or metastases. The injury of a solid tumor by exploratory puncture is so much more possible because, in doubtful cases, it is most apt to be encountered after passing through a stratum of ascitic fluid. Finally, the injury of a large vessel of the abdominal walls or the cyst-wall may cause hemorrhage and even death, or a portion of intestine situated in front of the tumor may be injured. All these dangers must be recognized in order to judge correctly of the value of exploratory puncture.

We will now revert to the information furnished us by an examination of the fluid.

The fluid of a proliferating ovarian cyst is usually thick, colloid, with a sp. gr. of 1015 to 1030; it does not always precipitate on boiling without the addition of acid; generally contains paralbumin (mucin). Cylindrical epithelium cells are the principal formed elements.

The exceptions are: very thin, serous fluid; presence of urea or allantoin; spontaneous coagulation on exposure to the air (in cystic fibromata of the ovary); absence of paralbumin, especially when the fluid looks like pea soup (papillary cystoma); microscopically, white blood globules.

The fluid of dropsical Graafian follicles cannot be distinguished from that of parovarian cysts; it is characterized by its colorlessness, slight opalescence, low sp. gr. (1002 to 1008) abundance of chloride of sodium, usually absence of paralbumin; microscopically, precipitate often wanting, often nothing more than nuclei and granules; otherwise scanty cylindrical epithelium; also ciliated epithelium in parovarian cysts.

Exceptions: thicker fluid, red or brown from mixture with blood, sp. gr. 1015 to 1025.

Ascitic fluid has a low sp. gr. (1008 to 1015), is thin, light yellow or greenish, deposits albumin on boiling; no paralbumin (mucin). The formation of a slight clot after prolonged exposure to the air is important. The microscope shows wandering cells, no cylindrical epithelium. Exceptions: darker color from mixture with blood, presence of paralbumin (mucin), absence of coagulum.

Cystofibromata generally furnish scanty fluid of a lemon yellow color, more rarely bloody; sp. gr. about 1020. Characteristic is the rapid coagulation of the entire fluid into a transparent clot; this occurs in about one-third the cases. No characteristic microscopic constituents. Cholestearin frequent, cylindrical epithelium always absent.

Echinococcus fluid has a low sp. gr. (1008 to 1010), no albumin or mere traces; leucin, grape sugar and inosite. Microscopically: hooklets or scolices, sometimes pieces of the membrane containing the chitin bodies.

In hydronephroses the fluid is thin, of low specific gravity (1005 to 1018), and of different colors; contains urea, leucin, tyrosin or kreatinin. Exceptions: mucous character; contains mucin, absence of urea, kreatinin, etc. Cheesy character of the fluid.

It must be acknowledged that, as a rule, the character of the fluid of ovarian cysts furnishes sufficient data to distinguish it from ascites and echinococci. We must also emphasize the fact that puncture clears up the diagnosis in those cases of free accumulation in the abdomen which result from the rupture of ovarian cysts, or the secretion of papillary proliferations that have perforated the walls of a cyst. The demonstration of the ovarian character of the fluid may thus prove the origin of the

free fluid. When the results of the examination are positive and characteristic, they are sometimes decisive as opposed to the doubtful results of physical exploration.

It is often said that puncture, when performed properly under strict antisepsis, is hardly attended with any danger. This is true of the puncture of a large, undoubted ovarian cyst. But diagnostic puncture is always made in doubtful cases, and we may be dealing with one of those numerous tumors in which puncture is very harmful or even dangerous to life. These include echinococci, renal dropsy, abscesses, dermoid cysts, suppurating ovarian cysts, and many others. Even an immediate laparotomy may not always prevent the bad results of a puncture made in the wrong place. And if we consider that an exploratory incision can be made with greater certainty and is perhaps less dangerous, at least in some cases, than puncture, and that the incision furnishes greater certainty of diagnosis than puncture, we will abandon exploratory puncture more and more.

Moreover, the literature contains numerous cases in which puncture has afforded no light, or has even led the physician astray.

My own experience has led me to employ puncture less and less for diagnostic purposes. I recently employed puncture again, after the lapse of years. The case was one of a moderately large tumor, which I regarded as ovarian. The diagnosis was rendered difficult by the very thick abdominal walls and other circumstances. The fluid evacuated by puncture was very bloody, contained a large amount of albumin, but no paralbumin; numerous leucocytes, but no epithelial cells. This was opposed to ovarian tumor. On account of the undoubted cystic character of the tumor and its connection with the genital organs, I nevertheless stuck to the diagnosis of an ovarian or parovarian tumor. Laparotomy proved a subserous, papillary cyst of the right ovary; the numerous papillæ contain cylindrical epithelium.

Lawson Tait was almost always disappointed by diagnostic puncture, while Rokitansky appears to employ it before almost every ovariectomy, and Zweifel always punctures before operating. We are convinced that both operators will abandon this principle. In one case Zweifel observed acute peritonitis after puncture. Other cases will hardly be wanting if puncture is often performed.

The term exploratory incision has been applied euphemistically to those cases in which, after incision of the abdominal walls, the diagnosis is found to be wrong, and the wound is closed forthwith. Prior to fully developed antisepsis there was every reason for avoiding incisions which were not followed by extirpation, since they often resulted in death from the most acute septicæmia. This was almost the rule in malignant tumors and carcinosis of the peritoneum. At the present time this is changed. If an incision alone is made, there is hardly ever any reaction

when antisepsis is carried out strictly. Although exploratory incision is to be restricted as much as possible, if only to spare the patient a several weeks, stay in bed, we must nevertheless make an incision (in some cases it is even preferable to puncture) when, after exhausting all other methods of examination, it remains doubtful whether we have to deal with a tumor which can be extirpated with advantage to the patient.

It must be acknowledged that even the incision sometimes leaves the matter doubtful, but it will almost always satisfy us, at least, as to the character of the tumor, and whether extirpation is possible and advisable.

I am acquainted with a case, in the practice of another physician, in which this did not prove true. A tumor situated in the pelvis and also projecting above it, had been regarded as an extra-uterine pregnancy, and extirpation was attempted through a long transverse incision in the posterior fornix. After exposure it was found to be a new growth and laparotomy was performed. The tumor now looked like a bilateral myoma situated in the broad ligaments. It was really a bilateral, pedunculated fibro-adenoma of the ovary which I successfully extirpated several months later. The tumor on the right side had partly developed subserous.

CHAPTER XXIV.

TREATMENT OF CYSTOMATA.

NON-SURGICAL TREATMENT.

IN former times attempts were made to check the growth of ovarian tumors, or to cause absorption, by internal remedies. Diuretics, diaphoretics and resolvents were employed. Mercurials and iodine were used most frequently; next *liq. kali caustici* and *calcaria muriatica*. Even in recent times some regard medicinal treatment as not entirely useless. Boinet and Courty speak of cures, the latter writer in consequence of iodine inunctions, tonic remedies, and particularly the use of gold-oxide. Even Oppolzer claims to have reduced the size of a tumor to two-thirds its former volume by the use of iodine-glycerine. Other cases are referred to by Boinet, Peaslee, and Gallez.

It may be said, concerning almost all such cases, that the diagnosis was uncertain. At all events the cure of a proliferating cystoma by internal remedies is inconceivable to us, and the action of internal remedies upon simple cysts is at least not positively proven, and, at all events, must constitute a very rare exception.

This is also true of the mineral water and bath cures which are still recommended by many physicians. On the contrary, we must warn against subjecting the patient to any exhausting treatment, which will only accelerate the loss of strength.

Indeed, this is one of the most important principles in the general treatment of the disease. Not to do anything that will produce exhaustion, and to avoid everything that may cause irritation of the ovaries, are cardinal maxims. The diet should be nutritious, but easily digestible, appetite and disassimilation should be kept active by exercise and fresh air. Bodily rest is indicated during menstruation, especially if it is profuse or painful. Sexual excitement is unfavorable, and particularly the occurrence of pregnancy. Scanzoni justly claims that bath cures may prove injurious; not alone on account of the labor connected therewith, but also by the action of the warmth on the abdomen.

The occurrence of complications or functional disturbances of various organs may necessitate medicinal treatment. It is often necessary to relieve constipation, and, in later stages, to stimulate the appetite. The

more violent peritonitides usually furnish an indication for immediate surgical interference. Medicinal treatment of cases, in general, need only be considered when, for any reason, extirpation is inadmissible, or, at least, not indicated forthwith.

Methodical compression of the tumor and electrolysis constitute transitions to surgical treatment. The former is employed alone, in combination with internal treatment or with puncture. Hamilton and Seymour, Morley and others, favor compression, and Seymour even claims to have produced diminution in the size of the tumor by frictions, massage, and daily percussion, for which Hamilton devised a special instrument. This may constitute a means of exercising the patience of those physicians who have no other occupation, and may be safely left to them.

Treatment with electro-puncture is not new; in 1856 Jobert referred to several cases.

In recent times it has been employed by Semeleder and Fieber. The latter introduces one pole into the tumor, the other is applied externally. While Fieber does not mention the number of cured cases, but speaks, without giving details, of a tumor as large as a man's head, and even of a larger one, which were cured, Semeleder states that he has cured unilocular and multilocular tumors. In addition, a few cases of improvement, which were not published, have occurred in recent times.

That a diminution of even multilocular tumors has been effected by electro-puncture in some cases, must be conceded as possible. It is even possible that this lasted permanently and amounted to recovery. Recovery, in the strict sense of the word, of unilocular tumors is more readily conceivable, but has not been indisputably proven. But, at all events, such cures are and will always remain very exceptional. With regard to the efficacy of electro-puncture, it will always be necessary to prove that the favorable effect is really due to the electrical current, and not merely to the repeated punctures, which perhaps permit the fluid contents of the tumor to escape into the abdominal cavity.

This mode of action is the most probable, as in the case reported by Hesse. In a woman, aged forty-three years, Hesse and Noeggerath had diagnosed an ovarian tumor two years before. In two years the circumference of the abdomen had increased from twenty-nine inches to thirty-five inches. After the first sitting, in which the positive pole was applied to the portio vaginalis, the needle of the negative pole introduced into the tumor, the circumference diminished three inches, and after three sittings it had fallen to twenty-seven inches. Very profuse diuresis set in. This circumstance is explained most naturally by assuming a profuse evacuation of fluid into the peritoneal cavity.

Mundé believes that decided improvement or even cure was effected in 55 per cent. of the cases, while Ultzmann reduces the value of electrolysis to zero.

CHAPTER XXV.

SURGICAL TREATMENT OF CYSTOMATA.

THE surgical treatment is manifold. We will consider: 1. Puncture; 2. Puncture with subsequent permanent drainage and incision; 3. Injection of irritating fluid; 4. Extirpation.

PUNCTURE.

Puncture, apart from its diagnostic objects, is employed as a palliative or radical measure.

Its palliative effects are almost always sought for, or, at least, almost the only ones attained. Until very recent times it has been employed much too often. Not alone should the direct danger to life be taken into consideration, but it must not be forgotten that the evacuation of the cyst is generally followed at once by reaccumulation. This entails a considerable loss of albumin, which is not unimportant; the first puncture must soon be followed by a second, and this by others at constantly shorter intervals. The larger the cyst and the amount of fluid evacuated, the greater is the immediate effect, but the more rapid is the reaccumulation, partly because the secreting surface is so extensive, partly because the pressure is diminished more strongly. In a large cyst 10 kilo. fluid may reaccumulate in a few days after puncture, and this causes an enormous loss of albumin. In addition there is the not infrequent direct loss of blood, which occurs so often after puncture, especially in papillary cysts, as a simple result of the diminution of pressure, and consequent rupture of the wide, thin-walled vessels of the papillæ. Indeed, we not infrequently see patients, in whom puncture was unattended with febrile or inflammatory reaction or with external hemorrhage, rapidly lose strength in the first few days, and slowly recover from the acute loss of albumin.

In view of these facts, it is well to restrict the indications for palliative puncture as much as possible. It is made necessary most frequently by the compression of the abdominal or thoracic organs. The most imperative indication is the great dyspnoea produced by the pushing up of the diaphragm and the compression of the lungs. This may even constitute a vital indication, and the puncture may temporarily save life. The kidneys may also furnish the indication for paracentesis. The compression of these organs may cause dangerous diminution of the urinary secretion, and even complete anuria. Disturbances of the digestive canal furnish a

more frequent though less urgent indication. Symptoms of incarceration, complete obstruction and beginning ileus may imperatively require puncture, though without any certain prospect of success. This may happen in large tumors as well as in small ones which are incarcerated in the pelvis. Finally, a complicating pregnancy may demand palliative puncture. The pressure symptoms and dyspnoea are then apt to become annoying, and experience also teaches that there is danger of rupture of the cyst in this complication. But we must lay stress on the fact that in all these cases, not even excluding the end of pregnancy and childbed, ovariectomy without previous puncture is the more proper method, and that puncture is only indicated exceptionally, in specially urgent symptoms or when ovariectomy is not practicable. In very large tumors, especially when marked œdema is present, it may be advisable to puncture one to two days before ovariectomy. It is advantageous not to remove too suddenly the entire contents of such a very much distended abdomen. Moreover, the œdema often disappears rapidly after partial evacuation of the tumor, and this is of benefit during ovariectomy.

Puncture for the purpose of effecting a radical cure has been pushed into the background by the excellent results of ovariectomy, and is hardly ever performed.

There is no doubt that in a number of cases, puncture has caused disappearance of the tumor for years, and in others has been followed by a radical cure. Almost all the cases occurred during the last decennium, the majority in parovarian cysts. A few may here be mentioned:

Atlee: woman aged forty years, removal of thirty-five pints clear, transparent fluid. Cure for ten years. Then another tumor, from which thick, dark fluid was removed. Extirpation. The cyst was situated in the broad ligament.

Atlee: woman aged twenty-five years. Puncture two years after beginning of disease. Relapse after seven years. Second puncture, eighteen pints thin opalescent fluid, sp. gr. 1004. Cure for seventeen years.

Cases have also been reported by Martin, Thoman, Pitha and others, in which it was doubtful whether the tumor was ovarian or parovarian.

Spencer Wells mentions the following cases: Patient, aged thirty years. Cyst, pushing the xiphoid process to the outside. Puncture. Cure observed for three years. Girl, aged twenty years. Tumor noticed eighteen months, filling entire abdomen. Puncture, fourteen pints clear, light green fluid. Attack of peritonitis at end of two and one half years. Cure observed for seven years. Woman, aged twenty-nine years. Puncture; thirty-two pints perfectly clear fluid. Refilling at end of a year, then a fall on the belly. Profuse diarrhoea with rapid diminution of abdomen. Recovery observed five years. Widow, aged forty-two years. Large cyst. Puncture; dark brown, somewhat sticky fluid. Recovery for four years.

I add cases in which vaginal puncture was performed with radical results:

Chrobak's case of cure of a bilateral tumor is especially interesting. A tumor, as large as the fist, felt behind the uterus, is punctured from the vagina. The previously obstinate vomiting ceases forthwith. A second cyst is now felt above the other and also a tumor on the left side. At the end of nine months same condition of vomiting and violent pains in evacuations. The tumor appears the same as at first puncture. Puncture of the lower cyst, then through this puncture of second cyst on right side. Four and one half ounces clear serum escape. The left cyst is then punctured and furnishes similar fluid. Three years later the cure still complete.

According to Fuerst, Habit removed several pounds serous fluid by vaginal puncture. Nine years later patient died of phthisis, and the right ovary was found converted into a thick-walled cyst, larger than a walnut and containing thick pus; the left ovary contained a thin-walled cyst as large as a hazel nut and several corpora nigra.

Various other cases have been reported, and Clay even claims to have cured forty cases by a single puncture, and to have seen reaccumulation only in six cases.

My own experience concerning radical cures by puncture is very scanty:

A woman aged forty-five years, very large abdomen and extremely distinct fluctuation. Ascites could be excluded. Puncture (in 1866) through the posterior fornix. The fluid (a pailful) was perfectly clear; no albumin. The tumor disappeared. In May, 1867, it again extended to the scrobic. cordis. Second vaginal puncture; fluid similar to first. Traces of albumin and mucin; large amount of salts, and traces of uric acid. In December, 1871, I could find no trace of the tumor. The case was probably one of parovarian cyst.

Mrs. M., aged thirty-five years; noticed enlargement of abdomen in beginning of 1867; considerable œdema of feet in September. Abdomen larger than at end of pregnancy. General and very distinct fluctuation. Percussion left no doubt of the presence of a cystic tumor. Greatest circumference of abdomen 117 cm. Distance from symphysis to umbilicus 31 cm. Tumor not felt in pelvis. September 28, 1867, puncture; 9250 cbcm. cloudy, deep green fluid, sp. gr. 1027. Entire mass coagulates on boiling. Fluid contains albuminoids 43.75 per cent., sodium chloride 3.76 per cent., traces of phosphate of lime, carbonate of soda and fat, no cholesterin.

Puncture through the abdominal walls did not empty all the fluid. A median tumor remained, projecting nearly a handbreadth above the symphysis. Slight inflammation around point of puncture in a few days, and a hard exudation, the size of the hand, developed here. In a few weeks the exudation was absorbed, and then the tumor could no longer be felt. Nor was I able to discover it in May, 1877, nine and one half years later.

From the character of the fluid this tumor could hardly be considered other than a proliferating cystoma. But as, in rare cases, the fluid of simple ovarian and parovarian cysts may acquire such characteristics as the result of hemorrhage, torsion of the pedicle, etc., it is probably more justifiable to conclude that this was one of the exceptional cases. The retained fluid perhaps escaped through the puncture into the abdominal cavity and was absorbed.

Even unilocular tumors often relapse after puncture, and may finally require extirpation.

The literature shows that the cured cases often occurred in young

individuals, and not infrequently manifested slow growth. As a general thing, several punctures were required. Reaccumulation took place slowly. Even an apparent recovery for several years furnishes no guarantee against relapse. In one of Atlee's cases this occurred at the end of seven years. Hence the validity of the majority of the reported cases as proofs of radical recovery may be doubted, though recovery persisting for many years would amount practically to a radical cure. The literature shows that even large tumors may have favorable chances. But the principal point appears to be a favorable condition of the fluid. The lighter, more transparent and poorer in albumin than it is, the greater are the chances of radical recovery, or, at least, of slow refilling of the cyst. Two exceptions to this rule have been observed: in one the fluid was cloudy and oily, in the other clear and oily. In the latter there was probably, as in Stilling's case, a large amount of cholestearin. This undoubtedly indicates extensive, retrogressive changes in the epithelium of the cyst, and is therefore a favorable, rather than an unfavorable sign.

We may therefore assert that, in apparently unilocular tumors which appear, in all probability, to be parovarian cysts, an attempt at radical cure by puncture is justifiable, but that, on account of its uncertain results, no blame attaches to him who proceeds at once to extirpation.

Technique of Puncture.—The patient is placed in bed in dorsal or lateral decubitus, with the belly projecting over the edge of the bed. The sitting position is inadvisable because it aids the occurrence of syncope and prevents absolute rest immediately after puncture. The bladder is catheterized because spontaneous evacuation is often incomplete. The selection of the point of puncture is not unimportant. We must choose a place at which fluctuation is distinct and percussion proves the apposition of the tumor to the abdominal walls. It is also well to perform auscultation in this region. If a vascular murmur is heard there, it is possibly due to a large vessel of the cyst wall or abdominal wall, and it is then better to select another locality. In the rare cases in which a loop of intestine, which is empty of air and cannot be percussed, is situated in front of the tumor, an intestinal murmur may furnish an important note of warning. These conditions being fulfilled, the linea alba deserves the preference as the site of puncture, because large vessels of the abdominal walls are then certainly avoided. This line should therefore be selected unless examination renders it probable that the main cyst of a multilocular tumor will not be found in that locality. The large cyst of a multilocular tumor is probably applied to the linea alba if the fluctuation is uniform. On account of the position of the bladder the point of puncture should be nearer to the umbilicus than to the symphysis. If the main cyst is situated distinctly to the side, or puncture in the linea alba has not secured a satisfactory evacuation, we may select any other part of the abdomen to which the tumor is directly applied, and at which

injury of the inferior epigastric artery is certainly avoided. This may always be done, according to Monro, by puncturing midway between the umbilicus and a superior spinous process of the ilium. At all events we should avoid the region of the external border of the rectus abdominis. In large tumors puncture in the hypochondriac regions may be necessary. The navel is rarely selected, and only when the umbilical ring is dilated, the integument very prominent and a part of the main cyst is situated beneath it. Dumreicher mentions a case in which a woman was punctured seventy times through the umbilicus (for purposes of examination). When the umbilicus presents the foregoing changes, an ascitic accumulation is more apt to be situated behind it than an ovarian tumor. In complicating pregnancy, the puncture should be made high, especially as the fundus uteri cannot be palpated, and its position, as a rule, must be estimated. When punctures are repeated the first site should be selected, if it has afforded sufficient evacuation. This is especially true of punctures outside of the linea alba, since this furnishes the best guarantee that no vessel will be injured. Serres lost a patient from hemorrhage at the fifth puncture, Delpech at the fourteenth puncture; in both cases a new point of puncture had been selected.

Puncture is performed with an ordinary trocar, or one provided with Robert's or Thompson's apparatus for preventing the entrance of air into the cyst. The calibre of the canula must be sufficient (about 6 mm.) to give exit to even thick colloid masses. A length of 8 cm. may be necessary if the abdominal walls are very thick. Thompson's trocar is arranged in such a way that the stylet, with which the canula is firmly connected, may be drawn back into the long handle and closed hermetically. To effect this the stylet must be provided with leather, like the piston of a syringe, because metal cannot be applied hermetically to metal. To afford escape for the fluid the canula is provided, near the handle extremity, with a branch tube, which is given off at a right or acute angle, and to which is fitted a rubber tube. The stylet being drawn back, the rubber tube is filled with water, then the stylet pushed forward and thus air excluded from the canula. Spencer Wells' trocar is not to be recommended for puncture through the abdominal walls.

The trocar is placed vertically upon the selected site, and then pushed through without any rotatory movement. If the cyst is small and flabby, an assistant must steady it from the sides with both hands, push it against the abdominal walls, and at the same time put the flabby abdominal wall on the stretch. If it is feared, nevertheless, that the penetration of the abdominal walls will prove difficult, the skin, which always offers the greatest resistance, should be incised. The trocar, when placed directly on the subcutaneous tissue, almost always perforates the linea alba and cyst-wall with moderate pressure. This method is still more to be recommended in puncture of the abdomen if only a small amount of

ascites is present, inasmuch as we are more apt to avoid injury to the gut.

After the trocar has entered the cyst, the stylet is withdrawn, and if Thompson's instrument is used, the fluid allowed to escape through the tube, whose lower end is dipped in water. If this instrument is not used, the greatest care must be taken to prevent the entrance of air into the cyst. So long as the fluid flows in a continuous stream there is no danger. But if it flows feebly and its rapidity varies markedly with the respiratory movements, the diminution of intra-abdominal pressure during coughing, sneezing, etc., may cause aspiration of air. This occurs more frequently from the kneading of the abdomen, which was formerly resorted to in order to evacuate the remainder of the fluid.

Such manipulations are dangerous when an ordinary trocar is used. Here we may only employ a constant, gradually increasing, never suddenly ceasing pressure. This is effected better by the hands of a reliable assistant than by bandages which are placed around the abdomen and drawn crosswise over the back. When the flow of fluid subsides, the physician must keep the finger in the neighborhood of the puncture opening, and close it at once if the intra-abdominal pressure diminishes. All these precautions are unnecessary when Thompson's trocar is used. If the canula is occluded by gelatinous masses or small "daughter cysts," the obstruction can be removed by pushing forward the stylet of Thompson's trocar. A further advantage of this instrument resides in the fact that, even during dorsal decubitus, the fluid escapes more completely, without compression of the tumor, on account of the syphon action.

If the fluid is mixed, after a time, with blood, its flow must be checked. It is probable that the blood is derived from ruptured vessels on the inner surface of the cyst. It is then better to retain a few litre of fluid than to favor increased hemorrhage by further diminution of the intra-cystic pressure.

The instrument is withdrawn by rotatory movements, the fingers of the other hand grasping the abdominal walls above the canula and compressing the wound, after the instrument is removed. If no blood escapes, a piece of English plaster is applied.

As a matter of course, antiseptic precautions must be thoroughly carried out, even in simple puncture.

One of the most disagreeable things that may happen in puncture, is to find that no fluid escapes. This may happen even if the fluctuation was distinct and superficial. We may then have passed through a layer of fluid into a solid tumor lying behind it. If no fluid appears, we should slowly draw the canula forwards. It will then enter the layer of fluid, and thus will prove of diagnostic benefit. If an abundance of fresh blood escapes instead of the expected fluid, it is very probable that a more or less solid tumor has been punctured, and the trocar should be removed

as quickly as possible. If we suspect a solid tumor at a not too great distance behind the abdominal walls, it is advisable to incise the skin with a scalpel, in order that the trocar may not be pushed in too deeply. If we merely intend to remove a thin layer of ascitic fluid surrounding an ovarian tumor, it is best to puncture merely with the lancet.

As a general thing, the blood from a punctured vessel of larger size in the abdominal or cyst-walls does not escape until the instrument is entirely withdrawn. As a rule, a hemorrhage from the cyst-wall will be extravasated into the cyst or abdominal cavity; one from the abdominal wall will escape externally, either entirely or in part. In the latter event, a Carlsbad needle is passed through the entire thickness of the abdominal wall below the puncture and a thread drawn around in figure of 8. If the needle is not introduced to a sufficient depth, death from hemorrhage from a deep vessel may occur.

An internal hemorrhage can only be inferred from the symptoms of acute anæmia. When this is unquestionable, the abdominal walls must be incised in order to disclose the source of hemorrhage, and must be treated according to circumstances.

Syncope is not apt to occur if the patient has been kept in a horizontal position. It is to be attributed to cerebral anæmia resulting from too rapid escape of the fluid, and is relieved by checking the flow and administering stimulants.

The usual plan of bandaging the abdomen firmly, after puncture, in order to antagonize the diminution of intra abdominal pressure and the rapid reaccumulation of fluid, does not seem to be satisfactory. The desired constant pressure is generally illusive, either because the bandage soon slips, or, if the abdomen is entirely empty, because it stretches from the spine of one ilium to the other. It is better to place upon the abdomen a sand bag of sufficient width and weight. But this matter is not very important.

Puncture is associated with various dangers. The most frequent one has been suppuration or gangrene of the cyst. However slight the symptoms which are caused, at first, by such a process, it soon induces a rapid loss of power, which accelerates the fatal termination, unless the tumor is extirpated. Febrile movement begins a few days after the puncture. It sometimes begins with a chill, but this is usually absent. At the end of two to three weeks the fever assumes a hectic type. In the morning the temperature is normal or nearly so; at night there is an exacerbation of 1 to 2°, accompanied not infrequently with chilly sensations. The fever continues until death, and gives rise to increasing weakness. Pains are absent unless peritonitis is also present, and it is this very absence of pain and tenderness, associated with fever beginning soon after puncture, which enables us to diagnose suppuration of the cyst with almost complete certainty. This condition is of the greatest importance, inas-

much as it furnishes an indication for the speedy performance of ovariectomy.

Suppuration of the cyst results from the use of an unclean instrument, or the entrance of air. Both may be avoided with certainty.

This is, unfortunately, not true of the second danger, *viz.*, the extravasation of fluid into the abdominal cavity. This undoubtedly occurs very frequently, just as ascitic fluid very often escapes through the much longer canal in the abdominal walls. As a general thing, the extravasation runs a latent course. In other cases peritonitis follows. This depends chiefly on the quality of the cyst fluid. Apart from pus and ichor, the contents of dermoid cysts are especially dangerous to the peritoneum, while a considerable proportion of cholestearin in colloid fluids does not appear to be at all injurious.

Other things being equal, fluid is more apt to escape into the abdominal cavity if the trocar is of large calibre. If a mere exploratory puncture is intended, or if, at the beginning, it is found inadvisable to evacuate all the fluid, we should at least remove a not too small quantity, so that the cyst may become flabby, and the probability of the subsequent escape of fluid is diminished. The diagnosis of the escape of fluid can be made with certainty if we are able to demonstrate free fluid, which was not present before. Perhaps this may be done, in the future, by the detection of peptonuria. The escape of fluid is always probable if puncture is soon followed by peritonitis.

In exceptional cases the tumor is ruptured by the impact of puncture, and peritonitis is thus produced.

Less frequent than the danger of suppuration of the cyst and peritonitis, but even less easy to avoid, is that of hemorrhage into the cyst from perforation of a larger vessel of the abdominal or cyst-walls.

If we are compelled to make the puncture to one side of the linea alba, it is difficult to avoid injury to the epigastric artery with absolute certainty when there is hernia lineæ albæ, unless we remain in the immediate vicinity of the median line or approach very closely to the ilium. Brueninghausen observed injury of the epigastric artery and fatal termination on the same day in two cases of puncture, according to Monroe's plan. Various other cases have been reported. Spencer Wells observed, in the practice of another physician, a fatal hemorrhage from a vein situated immediately outside of the peritoneum, and which ran from the navel to the liver.

Either arteries or large veins in the cyst-walls may be injured and cause fatal hemorrhage. Cases have been reported by Delpech, Chomel and Scanzoni. Ford saw a case in which the spleen was punctured. Peaslee perforated a thick vein of the omentum, which was situated in front of the tumor; the patient bled to death in eighteen hours.

As a rule, the projection of the intestine in front of a tumor is recog-

nized by percussion. But Spencer Wells observed a case in which this could not be done. I have had a similar experience. There was dullness on percussion over the entire anterior surface of the large tumor, but at the ovariectomy it was found that a long loop of the small intestine ran transversely across the tumor, and was adherent to it. The gut was collapsed, and could have been easily injured during puncture.

The elevated bladder is endangered more rarely than the intestine. Ritouret mentions a case. Aran refers to Guignard's case, in which the uterus was situated in front of the tumor in such a way that it could have been readily injured in puncture. Voisin really injured the uterus in this way.

Finally, attention must again be called to the previously mentioned danger from puncture, that the escape of fluid and particles of the tumor may give rise to peritoneal metastases. Although this hardly ever occurs except in papillary tumors, yet this character of the tumor can rarely be excluded with certainty. Not without reason, therefore, Thornton attaches more importance to this danger than to all others, and condemns puncture in almost every case.

These dangers cannot be denied. But it is equally true that if no precautions are neglected in cases of ovarian cystoma, or simple cysts, the danger from puncture is really very slight. It cannot be denied that some operators have had very unfortunate experiences in this regard, but these date chiefly from an earlier period. In three cases Cruveilhier observed death within the first four days after puncture. Velpeau had four deaths after 310 punctures. J. Simpson observed several fatal cases. Fock collated the statistics of Kiwisch, Southam and T. S. Lee, from which it appears that among 132 cases of puncture, twenty-five (19 per cent.) died in a few hours or days. Peaslee expressed an extremely unfavorable opinion of the results of puncture, at least in polycystic tumors, and especially in the first puncture. He lost four patients among his first sixty-three punctures, and estimates the mortality in first puncture of a polycystic tumor at nearly 50 per cent.

There is no doubt that such unfavorable statistics depend upon the fact that formerly the causes and mode of prevention of the dangers were not sufficiently recognized. At the present time a fatal termination from puncture is rare, when all precautions are observed. But unfavorable results are observed occasionally even at the present time. Lusk reports two cases in which, after puncture with a narrow trocar and aspirator, death occurred in two days from peritonitis. Mundé reports a similar case; the ovariectomy, attempted after the onset of the peritonitis, did not save the patient. Reuss punctured a simple cyst and removed a thin, non-colloid, non-purulent fluid with a specific gravity of 1030. Purulent peritonitis followed, and the ovariectomy, which was performed five weeks later, showed various purulent foci and recent adhesions. It is not very

probable that, as Reuss believes, the peritonitis in this case resulted from the escape of fluid; an accidental injury is much more probable. Zweifel punctured after torsion of the pedicle. A puruloid, fatty fluid was removed, and such violent pains set in at once, that Zweifel performed ovariectomy two hours later, and saved the patient. The tumor was a dermoid cyst, and puncture was performed with Potain's aspirator and a canula 2.5 mm. calibre.

Among my eighty cases of puncture of an ovarian tumor there was not a single fatal termination, but in one internal hemorrhage set in and caused such marked collapse that laparotomy became necessary at the end of two hours. A large vein of the omentum had been perforated. After this was ligatured and the abdominal wound closed, the patient recovered.

In the consideration of this question, little value attaches to statistics of the length of life of the patients after first or repeated punctures. They show that some patients tolerate for years numerous punctures, and the evacuation of enormous quantities of fluid. They also show that such cases are, on the whole, rare exceptions, and that most patients die within a few years after the first puncture. But whether the punctures have hastened or delayed the course of the disease, cannot be decided from such statistics, on account of the differences in the cases and in the stages in which the cases came under treatment. The clinical observation of certain individual cases, however, proves conclusively that the enormous losses of albumin due to the repeated punctures, have accelerated the fatal termination. Apart from diagnostic purposes, from the rare cases in which an attempt at radical cure by puncture appears indicated, and from those in which puncture is a preliminary to extirpation, the trocar should only be used when the symptoms imperatively demand relief.

We may mention the following cases of rare resisting power of the body to numerous punctures: Bertrand punctured a patient thirty-five times in nine years, Cheselden fifty-seven times, and John Hunter eighty times in twenty-six years. Latham reports that 155 punctures furnished seven and one half hogs-heads of fluid, and Bamberger punctured 253 times in eight years. Griffin relates that 186 paracenteses furnished 751 gallons of a straw yellow fluid in nineteen years. Two cases have occurred in my practice, in one of which puncture was performed seventy-six times in six years, in the other 105 times in seven years. Both were cases of ascites, dependent on bilateral papillary tumors of the ovaries.

Although the number of such cases might be considerably increased, they are rare in comparison with the enormous number in which puncture effected very brief relief and became necessary at constantly shorter intervals.

It has also been held that paracentesis leads to the formation of adhesions, and thus impairs the chances of a subsequent ovariectomy. These adhesions, however, are generally confined to the immediate vicinity of

the point of puncture. In not a few cases they are entirely wanting. At all events they do not notably increase the difficulties or dangers of extirpation. Among 500 ovariectomies by Spencer Wells, 25.4 per cent. died. 265 (with 27.17 per cent. mortality) had been punctured before the operation. 235 (with 23.4 per cent. mortality) had not been punctured. The mortality increased with frequent punctures, but it was only 21.87 per cent in thirty-two patients, each of whom had been punctured three times.

The somewhat higher mortality of those who had been previously punctured, depends probably in part on the more advanced stage and greater duration of the disease, and very little upon the adhesions which have formed. At the present time such parietal adhesions have no influence whatever on the prognosis of ovariectomy.

In conclusion it may be said that puncture is to be looked upon as a mistake, unless performed in extreme necessity, for diagnostic purposes, or as a preliminary to ovariectomy in a proliferating cystoma.

PUNCTURE THROUGH THE VAGINA.

This has been performed, partly in order to secure more complete evacuation of the cyst, partly as a matter of necessity in cases in which small cysts could not be reached with certainty through the abdominal walls. It is a necessary condition of this mode of puncture that the tumor should be applied directly to the vaginal fornix, and that fluctuation should be felt there. This is true of few large tumors, since they rise out of the pelvis and then can only be reached high above the vagina. Although, in the majority of such cases, there is no organ between the cyst and the fornix, we are not certain of avoiding injury to important organs. But even when the tumor can be certainly punctured through the vagina, this mode of operation, as a rule, is not advisable. The main cyst is punctured much less readily from below than from above. In the former case, the danger of entrance of air is great, and finally, the vagina cannot be thoroughly disinfected with certainty, so that infection of the cyst through the point of puncture is not always to be avoided.

The proper field for vaginal puncture is furnished by those cystomata and cysts which, on account of their small size, cannot be reached with the trocar from above. But such small tumors only require puncture when they become incarcerated or form an obstacle to delivery and cannot be replaced above the entrance to the pelvis. Noeggerath urgently recommends the puncture of small tumors which are situated in Douglas's sac, because they always contain a bland fluid, but it must be remembered that dermoid cysts, with their dangerous contents, are almost always situated in the same locality, and can rarely be distinguished from simple cysts and proliferating cystomata.

Puncture is performed with a trocar of sufficient length. A curved trocar is not required unless the genitalia are very narrow. So far as possible the tumor is steadied from the outside by an assistant. Previous rectal exploration is always necessary in order to determine the position and boundaries of the tumor as accurately as possible. The uterus should also be sounded if its shape and position are not perfectly clear. The puncture is then made at the site of distinct fluctuation, if possible in the middle of the posterior fornix or not far from this locality, because accidental injuries, for example, to the uterus, are there avoided most surely. Thompson's trocar or an aspirator is urgently to be recommended, in order to avoid entrance of air.

Injuries to adjacent organs during vaginal puncture have probably occurred more frequently than have been reported. Vermandor, Boivin, and Dugès observed injury to the bladder, which had not been previously evacuated with the catheter. Tait observed three deaths after vaginal puncture in the practice of other physicians.

If the puncture is made with a trocar, this can only be done properly by the feel and without the use of the speculum. When the latter is employed, the fluctuation cannot be recognized well, on account of the tension of the vaginal walls. An incision is to be recommended in those cases alone in which an attempt is to be made to effect radical recovery by means of permanent drainage. As a matter of fact, simple puncture through the vagina has been rarely performed.

In addition to the case reported on page 181, I have also performed vaginal puncture in the following exceptional case:

Mrs. L., age thirty-two years, one child six years before; prolapse since that time. Abdomen has increased in size for some time. A uniformly fluctuating tumor, as large as the uterus in the eighth month of pregnancy, is found.

From the right upper portion of the tumor and running obliquely downwards to the left of the linea alba, is a somewhat tender band as thick as the little finger and 20 cm. long. It is regarded as the tube.

In front of the vulva is a prolapsus vaginae post. as large as a fist. It is easily reduced and fluctuates distinctly. On rapid reduction the size of the abdomen is visibly enlarged. Rapidly following quick compressions of the prolapse are recognized in the abdomen as concussions of the tumor. The portio vaginalis is situated high up anteriorly, immediately behind the symphysis. The uterine sound enters for a distance of 6 cm.

The vaginal wall is readily lifted up from the underlying cyst wall.

The cyst was punctured through the prolapsed vaginal wall and the entire contents (three to four kilograms) removed. The fluid was thickish, sp. gr. 1022, and contained a large amount of cholestearin. It contained 7.24 per cent. of solids, chiefly albumin.

The character of the fluid does not exclude the possibility of a parovarian tumor, but does not render it probable.

No reaccumulation of moment had returned at the end of six years.

Puncture through the rectum is still less worthy of consideration than

vaginal puncture. It is to be discountenanced even when the fluctuation of the tumor is most distinct in the rectum. The entrance of intestinal gases and fæces is apt to follow, and this will surely result in gangrene of the cyst. Tavignot seems to be the only one who has recommended this plan. Spencer Wells mentions a case in which the patient died of inflammation of the cyst a few days after puncture.

Compression of the abdomen after puncture has generally been adopted, in order to prevent rapid reaccumulation of the fluid. Isaac Baker Brown believed that methodical compression would even effect radical recovery. He applied abdominal compresses; these were retained in place by long strips of plaster, which, starting from the back, surrounded the abdomen on both sides. Then broad bandages were applied and fixed by passing around the thighs. At the same time diuretics and mercurials were administered. He reports six cured cases; in three cases recovery had lasted one to three years, in three others eight to fourteen years. May and Tanner have also published cases of recovery by this method.

Recovery by this plan is only possible in unilocular cysts. Although compression must be regarded as a rational method, yet it is questionable whether it produces a better effect than simple puncture, since the compression can only be continued for weeks (at the most, months), and, even after puncture, relapses may not occur for months or even years.

CHAPTER XXVI.

INCISION AND PUNCTURE WITH DRAINAGE.

THE rapid reaccumulation of fluid after puncture led to the notion of making a permanent connection between the ovarian cyst and the external surface of the body, so that the newly forming secretion would be discharged and the cavity of the cyst diminished in size or entirely obliterated. This object was attempted in part by making an incision of the cyst-wall from without or from the vagina, and then stitching the edges of the cyst wound to those of the abdominal walls, unless adhesion of these parts had been induced previously. The same object was also sought by puncturing the cyst from without or from the vagina, and then permanently retaining the canula or another tube (*sonde à demeure*).

At the present time incision is only employed as an auxiliary in cases in which the extirpation of the tumor cannot be completed. We will consider this plan in the chapter on ovariectomy.

The inevitable result of a permanent communication of the cyst with the surface of the body is suppuration or gangrene of the cyst. The entire danger of such a condition does not become evident at once. Sooner or later it must prove fatal by exhaustion, ichorrhæmia or septicæmia, unless the sac is obliterated. The majority of patients do not survive until obliteration occurs. In addition to the dangers connected with suppuration, there is also the more immediate danger of effusion into the abdominal cavity and diffuse peritonitis. This danger has been combated in various ways, by the prior application of caustics to the abdomen in order to produce adhesive inflammation, by the introduction of needles into the cysts, or the use of peculiar trocars which, after their introduction, permit the protrusion of spring blades which press the cyst against the abdominal walls. All these methods are uncertain and cannot certainly prevent the danger of the escape of fluid. In vaginal incision or puncture, however, this danger is very slight.

The first incision was made by Robert Houston in the second deccennium of the last century. He first punctured the tumor with a lancet, but as nothing escaped, he gradually prolonged the incision until it was 4" long, removed the gelatinous masses by means of a pine chip wrapped in charpie, and partially sewed up the wound. The patient recovered. Le Dran, who first operated in 1737, converted this plan into

a regular method. *Fistulæ* were left over in most of his patients. In one case in which the patient remained dangerously sick for weeks after the operation, the wound closed entirely at the end of two years.

Le Dran's method was adopted by some writers, entirely discarded by others.

Opening of the cyst by caustics has been employed much less frequently than incision. Demarquay reports a case in recent times (1870). He opened a cyst with decomposed contents, by means of zinc paste. Constant irrigation of the sac was followed by gradual shrinking and recovery. Howitz cauterized a unilocular tumor in ten sittings with Vienna paste. A large amount of bloody fluid was removed, but the patient died at the end of a week with symptoms of inflammation of the cyst-wall. Tilt's patient barely escaped with her life, after the gangrenous cyst had perforated into the intestinal canal; a fistula remained for five years. Bribosia has also reported a case in which recovery occurred.

Treatment with permanent canulæ has been employed much more extensively. Ollenroth's favorable case created a sensation. After puncture had been repeated seven times (pus was evacuated at the last puncture), Ollenroth inserted a silver canula. Gangrene of the sac occurred, the discharge ceased in twenty-seven days, and the canula was removed. The patient slowly recovered. Pagenstecher had an equally favorable result. A fistula remained for five months, but the patient recovered completely, and gave birth to another child. Desprès and Boinet also report favorable cases.

Jobert seems to have employed this method most extensively. After every puncture he allowed the canula to remain a number of hours, in order to evacuate the fluid entirely and to prevent its passage into the peritoneum.

But the favorable cases are rare. The majority of the patients tolerated the suppuration only for a short time and died in a hectic state. Maisonneuve observed six cases of multilocular cysts which had been treated in this way, and in all of which a fatal termination occurred within six months.

The canula has also been allowed to remain after vaginal puncture. Schwabe (1836) allowed the catheter to remain two weeks; recovery was still complete at the end of six years. In 1846 Kiwisch reported his first case and became an ardent advocate of this plan. He recommended the operation in unilocular tumors alone, and therefore made an exploratory puncture to satisfy himself concerning this characteristic of the tumor. Kiwisch punctured the cyst with a trocar and then dilated with a bistoury, until the fingers could be introduced. He then inserted a tin tube, which remained a few weeks and through which warm water was injected several times a day, until suppuration ceased.

Scanzoni has had the most extensive experience and the best results

with this method. He punctured only unilocular cysts with a tolerably wide trocar, ten inches long. If the fluid is too thick to flow through the canula, Scanzoni pushes a specially constructed knife through the canula, and dilates from one to one and a half times its width, or accelerates the discharge by injections of water. In some cases no reaction ensues, and the canula may be removed at the end of a week. In other cases there are more or less violent general symptoms, resulting from inflammation of the cyst-walls. Scanzoni noticed this six times in twenty-three cases; all six cases terminated in radical recovery. Violent peritonitis did not occur in a single case. Among the twenty-three cases, reaccumulation soon occurred in five; four passed out of observation. Radical recovery occurred in fourteen cases, and in some was found at the end of twenty years or more.

Two favorable cases were reported by Carl Braun, and three cases (two dermoid cysts) by Simon Thomas. Noeggerath treated six cases in this way, but two terminated fatally.

Noeggerath tabulates the results in fifty-three cases. In forty-eight cases with fifty-five operations the treatment was successful thirty-four times. In four the result was undecided, and in fourteen there was a fatal termination (29 per cent.) Among the fourteen fatal cases, death resulted in one from hemorrhage, in four from primary peritonitis, in seven from septicæmia and secondary peritonitis:

From the present standpoint of the operative treatment of ovarian cysts, and from the experience at our command, incision or puncture with drainage from the abdominal walls is to be entirely discarded as a primary method. Hardly any one will support A. Stimson's view, that incision and stitching of the sac to the abdominal wound should be substituted for ovariectomy in cases of undoubted adhesion of the tumor. The only question is in how far is this stitching of the sac justified after fruitless attempts at ovariectomy. The primary operation of incision and drainage is extremely dangerous, even in those cases in which small tumors, which are situated low in the pelvis, are applied closely to the fornix. We can hardly ever be able to ascertain whether the tumor is not a dermoid cyst, and such a one may never be treated in this way.

CHAPTER XXVII.

INJECTION OF IRRITANT FLUIDS.

THE notion of producing retraction of ovarian cysts by irritating fluids was entertained as early as the beginning of this century. Injections of solutions of sulphate of zinc, port wine and alcohol were employed by Denman, Bell, Brenner, Jobert and others.

These methods met with no approval. In 1846 Alison first employed iodine injections. In 1852 Boinet's recommendation secured numerous adherents of this plan, especially in France.

The rapid adoption of this method is not astonishing. At a time when ovariectomy had just begun to meet with success, every one was glad to possess a method which undoubtedly produced radical recovery in a number of cases, and at least delayed the course of others.

But since better results have been obtained with ovariectomy, iodine injections have been suddenly abandoned, and only scattered cases are occasionally published.

Boinet and Velpeau have furnished large statistics concerning the success of the method. Among 130 cases in which iodine injections were employed, sixty-four were cured, thirty-six improved temporarily and thirty died. In twenty of the thirty fatal cases, however, the injection was combined with permanent drainage.

Boinet subsequently obtained better results when he confined the injections to unilocular cysts with serous or purulent contents. He then obtained almost 90 per cent. of recoveries; among his last twenty-nine cases twenty-seven were successful.

Many of the reports scattered in the literature are less favorable. James Simpson states that among forty to fifty cases death occurred once from collapse. Scanzoni injected iodine twenty-nine times. Eight cases were lost from further observation; not a single radical cure was seen. The reaccumulation of fluid occurred, in part, very slowly; in fourteen patients in the course of months, in six cases at the end of two years, in one case at the end of four years. Scanzoni believed that the reaccumulation of fluid in simple cysts was delayed by iodine injections, and subsequently (1875) he did not discard the method entirely. Veit operated in sixteen cases with three recoveries, one of them in a colossal simple cyst. Two patients died as the result of the operation, one from peritonitis,

the other perhaps from iodine poisoning. In G. Braun's eight cases recovery occurred six times. In one case recovery was noted at the end of five years, in two cases at the end of two years, in one at the end of one year, and in another ten months. These results are so much more noteworthy because some of the tumors were quite large. Billroth operated once. The patient remained well at the end of nine years, and had given birth later to two children. The sac could still be felt.

Very many operators observed fatal results. Langenbeck lost the first four patients upon whom he operated.

There can be no doubt, from the published accounts, that a number of radical recoveries have been effected by injections of iodine. But the majority of cases are uncertain with regard to permanent recovery, because they were not observed for a sufficient length of time. Thus, Boinet noticed rapid refilling of the cyst seven years after apparent recovery from the injection. G. Simon has laid stress on the relapses occurring in cases which were sufficiently long under observation, and on the impossibility of distinguishing proliferating cystomata from simple cysts.

That unilocular cysts alone are capable of cure by injections of iodine, is evident from the anatomical conditions in proliferating cystomata, and this is corroborated by experience. The best chances are offered by cysts with clear fluid, *i.e.*, those in which simple puncture also offers considerable prospect of radical cure.

The dangers of iodine injections are much greater than those of simple puncture. Apart from the possibility of slipping of the canula after partial evacuation of the cyst, and the entrance of the injected fluid into the abdominal cavity, it is also possible that the fluid will subsequently trickle into the abdomen through the puncture opening of the cyst. Cauterization of the cyst-wall by the iodine or subsequent rupture also takes place. Some of the patients die in this way from acute peritonitis. A further danger consists in the occurrence of acute iodism, which proves fatal with symptoms of collapse. Last but not least is the occurrence of suppuration of the cyst which accelerates the fatal termination by exhaustion due to the protracted fever.

These dangers may be combated in part by a careful selection of cases, and suitable methods of operation.

The following recommendations may be made concerning the technique of the operation; the cyst is punctured with a tolerably wide trocar, whose canula permits the passage of an elastic catheter (about No. 7 or 8). The contents of the cyst are now allowed to escape, in great part, without the exercise of pressure. Before the greater part is evacuated, an elastic catheter, which fills the lumen of the canula as completely as possible, is shoved far into the cyst, and is closed with the finger as the escape of the fluid begins to cease. The catheter is then connected, by means of

a short rubber tube, with the vessel which contains the iodine solution, but shut off at first by means of a stop-cock. The latter is opened as soon as the connection is made, and the solution is now allowed to enter the cyst under slight pressure. The quantity of the iodine solution depends on the size of the cyst or the amount of fluid which has been evacuated. In large cysts 400 grm. may be injected; in small cysts half this amount or less is sufficient. The fluid is allowed to remain about ten minutes in the cyst, and after closing the stop-cock to prevent the entrance of air, the cyst is carefully manipulated in order to bring the fluid thoroughly in contact with its walls. Or the same object is effected by changing the patient carefully from one side to the other.

The fluid is allowed to escape spontaneously by lowering the vessel at the end of ten minutes, unless any circumstances indicate its earlier removal. Its escape may even be facilitated by gradually increasing uninterrupted compression of the tumor. Two-thirds of the entire amount of fluid may often be removed. The catheter and canula are then cautiously removed, and the patient is kept absolutely quiet for forty-eight hours.

Simpson injected pure tincture of iodine (Br. Ph.); Peaslee the undiluted tincture of the U. S. Ph. Boinet employed 100 parts of the tincture (Fr. Ph.), 100 parts water and four parts potassium iodide. In subsequent injections the solution was made stronger, and finally the undiluted tincture was used. Guibout injected five parts iodine, five parts potassium iodide, fifty parts alcohol and 100 parts water.

The chief variations in the methods consisted in the circumstances that the iodine was allowed to remain, or the fluid was allowed to escape, but the catheter or canula was retained. This was intended to prevent the entrance of the fluid into the abdominal cavity through the puncture opening. But it possesses the disadvantage that air necessarily enters the cyst, and that gangrene ensues. The occurrence of the latter may be delayed by the iodine solution, but cannot be prevented.

The object of iodine injections could never have been to produce general adhesions of the often enormous cyst-walls. They could only diminish or abolish the secretion of the cyst-walls, and prevent reaccumulation of the fluid. In order to bring the entire inner surface in contact with the fluid, stress must be laid upon the amount of fluid, and the kneading of the cyst. Apart from the cases of cure, some well-controlled cases prove that the secretion may be reduced to a minimum. Thus, Cazeaux examined a patient in whom Boinet, eight years before, had punctured and injected a cyst containing 22 litre fluid. It probably contained about 1 litre when Cazeaux examined it. Such a slow and slight reaccumulation almost amounts to a radical recovery.

At first the secretion is sometimes increased after the injection. This, with the remainder of the cyst fluid and the injection fluid, re-

quires a certain number of weeks for its absorption. Hence the complete results do not develop for one to two months, and Velpeau, therefore, cautions against the too early repetition of the injection.

The injection, if performed successfully, causes no pain. If pains set in at once, it is an indication that injection fluid has entered the abdominal cavity. In addition there is the greater danger of iodine poisoning. The iodine is absorbed so rapidly from the cyst, that it appears within a few minutes in the saliva, and causes a metallic taste. If the absorption occurs very acutely and abundantly, violent symptoms may develop in one to two hours. A chill ushers in symptoms of collapse, coldness of the body, syncope, general tremor, nausea and vomiting, small, hard or imperceptible pulse, violent dysuria with diminished secretion, and a feeling of great prostration. These symptoms may terminate fatally in a few hours or days. Veit reports a case in which death on the eighth day was attributed to the action of the iodine, and Rose reports a fatal termination on the tenth day. The fluid had been left twenty-four minutes in the cyst. For the same reason Teale's patients presented grave symptoms, which terminated fatally in one case; in two others, the patients were unconscious for fourteen hours. Rose interprets the symptoms of iodism as the results of general tonic spasm of the muscular coat of the vessels (coldness of the body, imperceptible and frequent pulse, diminished urinary secretion) and of a specific affection of the peptic glands. The main danger consists in the possibility of the occurrence of heart failure, because the organ cannot overcome the increased resistance. In order to prevent the excessive absorption of iodine, Rose recommends subsequent injections of the sac with water.

The danger of iodism also appears to be increased by the use of pure watery solutions which are absorbed more readily. On the other hand, the use of pure alcoholic solutions (in the large quantities employed) possesses the disadvantage that the symptoms of acute alcoholism may be added to those of iodism, and as it seems, increase the danger. These experiences have led to the use of mixed, alcoholic watery solutions.

When this plan was first accepted, the indications for the use of iodine injections were very broad. It was employed in multilocular cystomata, and even in combinations of cysts with solid tumors. But later Boinet, the most enthusiastic advocate of the operation, drew the line much more closely, and only injected unilocular cysts with non-colloid contents and healthy, thin, non-adherent walls.

At the present time, however, iodine injections are to be entirely discarded. They are altogether uncertain and dangerous, even more dangerous than ovariectomy.

CHAPTER XXVIII.

EXTIRPATION OF THE OVARIES.—OVARIOTOMY.— OÖPHORECTOMY.

HISTORY OF THE OPERATION.

THE history of ovariectomy is as brief as it is interesting. As early as the XVIIth century Plater and Schorkopf speculated on the possibility of extirpation of the ovaries. In the following century the notion was discussed by various authors, accepted by some, declared impracticable by others.

The real history of the operation begins with Ephraim McDowell of Kentucky, who was the first to operate according to well-defined principles, and with the conviction that the operation was justifiable. He may have been stimulated by the recommendations of his teacher John Bell of Edinburgh, where McDowell studied in 1793 and 1794. The first operation was performed in 1809 on a Mrs. Crawford, who survived the operation thirty-two years. After exposure of the tumor, which weighed twenty-two and a half pounds, through an incision nine inches in length, the intestines protruded and were allowed to remain on the table until the removal of the tumor. The pedicle was tied and replaced, the ligature brought out through the wound. Before closing the wound the patient was placed in abdominal decubitus, in order to remove the fluid contents of the abdominal cavity.

McDowell had eight recoveries among probably thirteen cases.

The second operator, Nathan Smith of New Haven, Conn., appears to have been ignorant of McDowell's cases when, in 1821, he performed his first operation. The case was one of simple cyst, containing eight pints of fluid. The bleeding vessels of the adherent omentum and the pedicle were tied with strips of leather, and the pedicle restored to the pelvis. The incision was only three inches long, and began below the umbilicus. The patient recovered.

Alban Smith was the third operator; his first operations were unsuccessful, later (1823) he operated successfully.

It was not until 1843 that the operation began to meet with general acceptance. In 1843 J. L. Atlee made the first bilateral ovariectomy. In the following year Washington L. Atlee began his numerous operations,

which amounted to 246 in October, 1871. He was followed by numerous surgeons, among others, Kimball, Dunlap, Peaslee, Bradford, White. In 1865, according to Peaslee, all opposition to the operation had disappeared in the United States.

In 1824 Lizars of Edinburgh, who had read the report of McDowell's first three cases, performed laparotomy, but found two healthy ovaries and no tumor. The latter had been simulated by the fat abdominal walls. In 1825 Lizars operated three times, once successfully; the other two operations could not be completed on account of adhesions. One of these patients died on the third day. Granville of London could not remove his first tumor (1827) on account of adhesions; the second time he extirpated a uterine fibroid instead of the ovary, and lost his patient.

These experiences long deterred English surgeons from performing the operation. A few single operations were performed by various surgeons, but it was not until 1842 that Walshe and Clay began their large series of operations; they were soon followed by Bird and Baker Brown.

The first operation in Germany was performed by Chrysmar at an earlier period than that in England. Of three cases operated by him in 1820, two died. In 1832 Ritter had one, in 1834 Quittenbaum had another successful result. A few other surgeons also performed the operation, but until 1850 there were only seven successful cases, and sixteen unsuccessful ones reported in Germany. Nevertheless Stilling made a decided advance (1841) by devising the method of extra-peritoneal treatment of the pedicle. This plan did not become known in foreign countries, and in 1850 Duffin, an Englishman, conceived the same idea.

Another great advance consisted of Hutchinson's invention (1858) of the clamp.

France delayed longest in recognizing the operation. Although Chereau published in 1844 the statistics of sixty-five cases, Woyerkowsky (1844) was the first to perform the operation in France. In 1856 and 1857 occurred the memorable discussion in the Paris Academy, in which, with the exception of Cazeaux, no one spoke in favor of ovariectomy. In 1862, Nélaton and Koeberlé began their operations. In 1864 the latter reported nine successful cases among twelve operations. Since then, Koeberlé has had by far the largest experience among French surgeons, has advanced our knowledge of the diagnosis of tumors, improved the technique of the operation in various ways, and extended the indications.

But the most decisive advance in the history of ovariectomy was made by Spencer Wells, who began his career as ovariectomist in 1858. His first case was an extremely rare one, an ovarian tumor which was covered by the mesentery. The operation was not completed, but the patient recovered. He then operated successfully in three cases, and in February, 1859, made a report on his first five cases. A few years later all opposition to ovariectomy had ceased in England. In his first publication

Spencer Wells emphasized the following points: the abdominal incision should not be larger than necessary; the pedicle should be cut far in front of the ligature and fastened externally; the peritoneum should be included in the stitches enclosing the abdominal wound; fresh air, cleanliness and rest are necessary conditions for success.

The experience of this surgeon, based on more than 1000 completed ovariectomies, will long remain the foundation upon which operators must build in advancing our knowledge of the diagnosis, the indications and the technique of the operation. Next to him the greatest contributions to our knowledge have been made by Washington Atlee, Keith, Baker Brown and Koeberlé.

Advances have been made in all directions. The diagnosis was made more certain and precise, so that wrong diagnosis or the improper selection of cases for operation became less frequent. Then the technique was improved. The clamp treatment was perfected, partly by improvement of the instruments, partly in other ways. Clay and Baker Brown devised the division of the pedicle by the actual cautery. The treatment of adhesions became more efficient in the hands of Spencer Wells, the after-treatment was simplified. Peaslee and Koeberlé recognized the dangers of retention of secretion in the abdominal cavity, and were bold enough to remove the infectious matter, partly by drainage, partly by reopening the abdominal cavity. Marion Sims perfected this method by peritoneal drainage through Douglas's sac. Finally, Lister's antiseptics reduced the dangers of the operation to an unexpected minimum.

CHAPTER XXIX.

STATISTICS OF OVARIOTOMY.

THE statistics of ovariectomy, though not so important as in the first period of the operation, present some noteworthy facts, and form a necessary amplification of its history.

Certain statistics bear upon individual factors, which may influence the result of the operation, such as the age of the patient, the duration of the disease, previous punctures, the size of the incision, the amount of loss of blood, the presence and extent of adhesions, the treatment of the pedicle, etc. We will here consider only the general results of statistics, and review the differences in the results in various countries and in the hands of different operators.

The earliest statistics of Atlee and Lyman include all the then known cases.

Atlee collated 165 completed operations and sixty-four deaths (33.3 per cent.). In addition, there were fifty-seven incomplete operations.

Lyman reported 212 completed operations with 57.22 per cent. recoveries, and eighty-eight incomplete operations.

Stafford Lee collected all cases from 1809 to 1846; these statistics were enlarged by Kiwisch, and later by John Clay, who gives the following table:

	Recoveries.	
Completed operations,	395	212 (54 per cent.)
Partial extirpations,	24	10
Extirpation of another tumor instead of an ovarian tumor,	13	3
Extirpation impossible on account of adhe- sions,	82	58
	<hr/> 514	<hr/> 283 (51 per cent.)

Peaslee then added the completed operations from 1860 to 1864. Among 150 cases 99 recovered (66 per cent.). Both series gave 57 per cent. recoveries. Dutoit's statistics, collected at the same time, gave almost exactly the same results.

The astonishing result that the greater spread of the operation was

attended by poorer results is probably to be explained, as Peaslee points out, by the fact that at first the operation was performed only by a few very skillful surgeons, later by numerous physicians who had had no experience. The difference was probably even greater than appears from the statistics. The more frequently the operation was performed, the more often did surgeons fail to publish all the cases. As a matter of course, this is especially true of the unfavorable cases of those surgeons who operated only a few times and with poor results.

Among 1087 cases of operation collated in Virchow and Hirsch's *Jahresbericht* for 1867 to 1874, there were 751 recoveries (69.1 per cent.).

In one respect these statistics show a great advance, the number of unfinished operations and diagnostic errors has greatly diminished.

Among Kiwisch's 122 operations twenty-two (18 per cent.) were not completed on account of technical difficulties, and there were 14 (11 per cent.) diagnostic errors. In 1853, Robert Lee reported sixty incomplete operations among 162 cases (37 per cent.). Dutoit's statistics, which extend to 1863, show that in England the operation was not completed in 15 per cent. of the cases, and that diagnostic mistakes were made in 3.2 per cent.; in Germany, there were 22 per cent. unfinished operations, and 4 per cent. diagnostic errors.

Grenser's statistics (1864 to 1870 in Germany) give different results; among 146 cases were seven unfinished operations and ten diagnostic errors, in all not quite 12 per cent.

Among Spencer Wells's first 500 cases there were twenty-eight unfinished operations, and twenty-four exploratory incisions, in all 9.4 per cent. But the unfinished operations are becoming constantly rarer. Keith had only one unfinished operation in 100 cases, Koeberlé not a single one in nearly 300 cases. The technical difficulties presented by extensive adhesions have been conquered more and more, and notable advances have been made in the certainty of diagnosis. But apart from the progress of science, both factors also depend, to an eminent degree, upon the individual skill of the operator.

Recent general statistics of different countries are furnished only by Switzerland, Italy and Russia.

Until 1882, 223 operations were performed in Switzerland with 178 successful results (80 per cent.); 178 cases were operated under strict antisepsis, with thirty-five deaths (19 per cent.); fifty-five cases without antisepsis with twenty deaths (36 per cent.).

Until 1883, 400 operations had been performed in Italy. The mortality sank in each 100 cases from 63 per cent. to 36 per cent., 27 per cent. and 21 per cent.

In Russia Solowiew collated 261 ovariectomies until 1882; in eleven cases the result was unknown. Among 250 cases there were ninety-three deaths (37 per cent.).

The statistics of individual operators, who have had a large experience in ovariectomy, are of interest in noting the advances made. At the present time, however, such results no longer furnish a criterion of the care and skill employed in the operation. Since antisepsis, which is the chief element of success, is now adopted by almost all operators, the selection of cases probably exerts the greatest influence on the results of the various operators. I disregard the rare cases of diagnostic error, but refer solely to the selection of cases among ovarian tumors. The principles entertained by operators in this respect are by no means the same. While some surgeons often exclude from operation specially unfavorable cases, particularly subserous tumors, others operate upon almost every case of ovarian tumor which comes under observation. As a matter of course, the indiscriminate operative treatment of all ovarian tumors will necessarily exert a considerable influence on the percentage of fatal cases.

Charles Clay began to operate in 1844. Until 1850 he had thirty-three operations with twenty-one recoveries (63 per cent.). Until December 1871 he had 250 operations with 172 recoveries (72.8 per cent.).

Baker Brown, until November 1867, 138 cases; 111 completed operations with seventy-six recoveries (68.5 per cent.), sixteen partial extirpation with three recoveries, and eleven exploratory incisions with five recoveries. Total 138 cases with eighty-five recoveries (61.7 per cent.).

W. L. Atlee operated (1844 to 1878) without antisepsis upon 387 cases with 127 deaths (64.6 per cent. recoveries.).

Gaillard Thomas operated (1863 to 1881) 203 times (sixty-seven antiseptically) with forty-nine deaths (75.9 per cent. recoveries.).

Dunlap (1843 to 1882), 169 operations with 134 recoveries (78.7 per cent.).

Kimball, 267 operations (seventy-five with antisepsis), 202 recoveries, (75.7 per cent.).

Spencer Wells (1858 to June, 1880) 1000 cases, 768 recoveries (76.8 per cent.). The mortality fell from thirty-four in the first hundred to eleven in the tenth hundred.

Keith (1862 to 1881) 381 operations, 340 recoveries (89.2 per cent.) Only five deaths in the last 140 cases.

Péan (until October, 1881) 306 ovariectomies with 245 recoveries (80.1 per cent.).

Koeberlé (until March, 1878) 305 operations with 231 recoveries (75.5 per cent.).

Krassowski (1862 to 1883) 128 ovariectomies, seventy recoveries (55 per cent.).

Schroeder (1877 to 1882) 300 operations, 258 recoveries (86 per cent.). Seven deaths in the last hundred cases.

Netzel (1869 to September, 1884) 200 operations, 166 recoveries (83 per cent.).

Thornton, 423 ovariectomies, forty deaths.

Lawson Tait, 405 ovariectomies, thirty-three deaths.

Author (1876 to May, 1885) 293 cases, 266 recoveries (90.9 per cent.). Four deaths in the last hundred cases. In addition one death from peritoneal cancer forty days after ovariectomy, one death from pancreatic cancer seven weeks after the operation, one death from hydrothorax nine weeks after operation. Among the last 150 operations were two series of successive recoveries of thirty-six and forty-three cases.

CHAPTER XXX.

PREPARATIONS FOR THE OPERATION.—INSTRUMENTS.

THE preparations refer in part to the patient herself. With the exception of those cases in which accidents, such as acute peritonitis from rupture of the cyst or torsion of the pedicle, prevent delay in the operation, the patient should be subjected to careful observation several days before ovariectomy. The patient must be free from fever, or if this is present, we must ascertain its cause. If it depends upon a complicating disease, a postponement of the operation may become necessary. Special attention is to be directed to the thoracic organs. If bronchial catarrh is present, the operation should not be made unless urgently necessary. The individual character of the pulse, abnormal slowness or frequency, irregularity, must be known to the surgeon in order that he may have a better judgment of the character of the pulse after the operation, and can employ this in prognosis. The urine must be examined for abnormal constituents.

Laxatives are administered to the patient during the last three or four days prior to the operation, until the fluid, slightly feculent evacuations show that the intestinal canal has been emptied. A few hours before the operation the rectum is emptied by an enema. A bath before the operation is often advisable, partly for the sake of cleanliness, partly in order to stimulate the cutaneous activity. The patient should avoid food that may produce flatulence, and no solid food is to be taken the night and morning before the operation. Some physicians administer a few doses of subnitrate of bismuth or *magnesia usta* for a few days.

In certain cases puncture is necessary as a special preliminary a few days before extirpation. It is particularly indicated in marked œdema of the abdominal walls or general anasarca, in order to relieve the œdema by effecting a decided diminution in the size of the tumor. Puncture is also useful in scanty diuresis and albuminuria, in order to secure more abundant diuresis and diminish the œdema. If respiration is notably interfered with by the size of the tumor, preliminary puncture may be advisable in order to make the narcosis free from danger, and to prevent cerebral anemia during the operation.

The operating room should be large, light and well ventilated. If strict antiseptic treatment is carried out, a large hospital need not be

dreaded. But we are undoubtedly safest if we possess a special, not too large operating room, into which septic cases cannot enter. We can operate with equal success, however, in a large, general operating room, if antiseptics is strictly carried out during the operation itself, and the air of the room is thoroughly disinfected with a large vapor spray immediately before the operation.

Since Bird's recommendation, much importance was long attached to high temperature and moist air in the room. Bird required a temperature of 25 to 26° C. Clay, Atlee and Peaslee adopted this principle, while Spencer Wells and Tanner regarded it as superfluous.

In the large majority of cases, in fact, the ordinary temperature (19 to 20° C.) will suffice. In presumably tedious operations, in very large tumors in which extensive parietal adhesions and the necessity of greater exposure of the intestines are probable, a temperature of 22 to 25° C., is not without advantage in preventing excessive cooling of the viscera. This is especially important in old and very feeble individuals. Noeggerath recommends that the patient, as a protection against cooling, should be placed upon a warm water bed.

An operating table of convenient height, and provided with leather cushions or a mattress and rubber cloth, is preferable to a bed. Koeberlé, however, always operates in bed, in which the patient remains. But special provision must then be made to prevent soiling of the bed. Moreover, most beds are inconveniently low. A. Martin operates upon a low, chair-like table, and sits between the thighs of the patient.

The patient's thighs are warmly covered; it is best to wrap the limbs in a warm, thick woolen coverlet, which is then completely covered with a rubber cloth. The shirt is drawn up as high as the breasts, the thorax clothed in a rubber jacket, which closes behind. The knees and arms are fastened to the table in order to prevent sudden movements.

Only a small number of instruments need be held in readiness. The absolutely necessary ones are: bistouries, forceps, especially a number of artery forceps, scissors and suture material, one or two forceps for grasping the tumor, and sponges or a substitute for sponges. A trocar, though not indispensable, is very useful in some cases. The ordinary push forceps for the abdominal walls may be replaced by clamps with a mouth-piece which is broader in front. A Pacquelin cautery for cauterizing bleeding surfaces is rarely employed. Hooks, *écraseurs* and catheters may be dispensed with. If the pedicle is cauterized, a cautery clamp is required.

Different operators require very different apparatus for suture of the abdominal walls and the dressing. Cotton will suffice if the typical or modified Lister dressing is not used.

The following may be said with regard to the individual instruments. The convenient, scissors-like clamps, which were first introduced by

Koeberlé (*pince hémostatique*), later by Spencer Wells and Péan, may be recommended as artery forceps, particularly for the abdominal walls.



FIG. 22.—ARTERY FORCEPS. (Koeberlé.)

The broad blades are suitable even for grasping widely cut veins, and they lie more conveniently than ordinary artery forceps upon the abdomen,

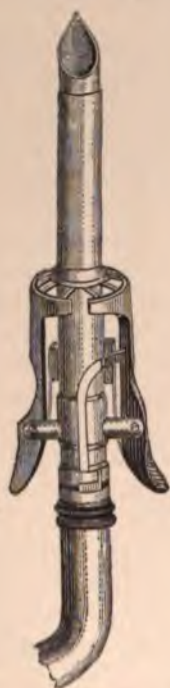


FIG. 23.—TROCAR. (Spencer Wells.)



FIG. 24.—OVARIAN CYST FORCEPS. (Nélaton.)

to the side of the incision. When the abdominal incision bleeds from numerous vessels, T shaped clamps are very useful, as their broad edges close many vessels at the same time.

The trocar employed to empty the tumor rapidly, should possess a wide calibre. The most useful one is that of Spencer Wells (Fig. 23) which consists of two metallic tubes moving in one another, the inner one being cut obliquely in front and half of it sharpened. After puncture the cutting inner tube is withdrawn.

FIG. 25.—CLAMP. (*Hutchinson.*)

In order to prevent the slipping of the tumor from the instrument during evacuation, there are placed in the middle of the instrument two spring claws, which grasp the cyst with their blunt teeth, without tearing it.

FIG. 26.—CLAMP. (*Spencer Wells.*)FIG. 27.—CLAMP. (*Hegar and Kaltenbach.*)

For the purpose of grasping the cyst after puncture, Veit has devised a trocar which permits the escape, from the middle of its wall internally, of four spines which are directed backwards.¹ Lawson Tait's and Koeberlé's trocars also possess an arrangement for retaining the cyst.

¹ Berl. Kl. Wschr., 1870, No. 4.

The cyst forceps is a large, long instrument with a clamp apparatus, and two round plates about 2.5 cm. in diameter, for grasping the cyst-walls after evacuation. I prefer Nyrop's, whose plates are strong and serrated on the inner surface, to Nélaton's instrument. The latter has spines on one plate, and corresponding holes on the other plate. On account of these spines it is less useful than Nyrop's instrument, when the cyst-walls are brittle.

These cyst forceps fulfill a double purpose. After removal of the trocar, their broad blades close the puncture wound completely, and prevent further escape of fluid, and they also serve as a hold for further removal of the tumor and separation of adhesions. The same object can also be attained by smaller forceps, such as those devised by Hegar and others.

Clamps for compression of the pedicle are intended for retaining the pedicle in front of the abdominal walls and preventing hemorrhage. Hutchinson's first clamp (Fig. 25) was shaped like a carpenter's compass. In order to secure more uniform compression of the pedicle, Spencer Wells constructed a clamp with parallel blades, but later he devised the one shown in Fig. 26, and retained it until he abandoned treatment with the clamp. The compressing parts in his last instrument are provided with broad, serrated surfaces, and are slightly curved on one another and on the flat; compression is effected by removable forceps, whose convenient shape permits the exercise of a good deal of force.

One blade has been provided with a groove, the other with a corresponding ridge, in order to make the compression more complete. Hegar and Kaltenbach have used the clamp shown in Fig. 27, in which the bolt *v* prevents slipping from the pedicle. The clamps of Atlee, Wilde and others have retained the principle of parallel blades with two screws, while an instrument formerly used by Koeberlé was constructed on still another principle. At the present time instruments for cauterizing the pedicle retain more importance than clamps for permanent compression.

After Charles Clay hit upon the idea of dividing adhesions with the actual cautery, Baker Brown began to employ this treatment upon the pedicle. He improved Clay's cautery-clamp. Baker Brown's instrument has broad compressing surfaces, an ivory base to protect the abdominal walls from the heat, and a vertical metallic ridge which prevents the slipping of the instrument on its upper surface. The improvements made by Spencer Wells and Skoeldberg have made this the best instrument of its kind. The unusually broad compressing surfaces are of the greatest importance as regards secure action in checking hemorrhage.

It is important to possess perfectly clean sponges, which are deprived of sand by boiling in dilute hydrochloric acid. They must be disinfected in an absolutely secure manner, and this is easily done with corrosive sublimate. If they are placed for some days in a 10.0 per cent. solution

of corrosive sublimate, we may be certain of their antiseptic properties. Shortly before the operation they are deprived of the corrosive sublimate by repeated washing and compression in a solution of carbolic acid. I do not think it is necessary to take new sponges for each operation, nor is this most certain as regards antiseptis. They need only be replaced by new ones when they have been soiled by dangerous substances during an operation. In laparotomies we employ four series of sponges, each of



FIG. 38.—BAKER BROWN'S CAUTERY CLAMP.

which is kept in a separate, closed porcelain tub. In this way a number of days always elapse before the same sponges are again brought into use. Only one assistant handles and cleans the sponges. The number of sponges is to be ascertained before the operation, and it is better that the number should always be the same, so that no mistake may occur. Probably many sponges have been forgotten in the abdominal cavity, although the number of published cases is small.

The number of assistants at the operation should be as small as possi-

ble. One for narcosis, one (a trained nurse) for the sponges, and an assistant for the field of operation. It is also convenient to have a fourth assistant for handing the instruments. The chief assistant must keep the field of operation clean while making the abdominal incision; after the abdomen is opened he must prevent, as far as possible, the prolapse of the intestines, the entrance of blood and cyst contents into the abdominal cavity, partly by pressing the abdominal walls against the tumor, partly with the aid of sponges. When the tumor is separated from the pedicle, the assistant must grasp the latter and soak up the escaping blood with sponges.

On the European continent chloroform is generally used as the anæsthetic. Spencer Wells has long preferred methyl bichloride; and has employed it in almost all of his last 900 ovariectomies. He claims that it is less apt to produce vomiting than chloroform, and is not dangerous to life. But its administration necessitates an inhalation apparatus, as it is much lighter than chloroform, and when applied with a simple mask, diffuses itself too extensively in the room, without producing sufficient narcosis of the patient. With Junker's apparatus very little methyl need be used. Spencer Wells uses 8 to 24 grm. during an operation. This produces complete anæsthesia, as I have found in about thirty of my own cases. It is advisable to produce profound narcosis, inasmuch as the waking of the patient during the operation may cause great disturbance. Profound narcosis is also a certain protection against prolapse of the intestines. For this reason it is not advisable to follow the recommendation of Riedel and Johnen, that narcosis is to be confined to the first stage of the operation (the abdominal incision) in order to prevent the frequent vomiting. Perhaps this recommendation may be followed with profit in patients suffering from heart disease. For the same reason Weintraub uses the mixture of chloroform and turpentine, recommended by Daneck, but this is said to produce severe headache.

Antiseptic measures are of the greatest importance. The most important one is the thorough disinfection of the hands and instruments employed in the operation. For this reason their number should be restricted as much as possible.

We have long carried out the following principles: The hands are disinfected with a solution of corrosive sublimate ($\frac{1}{10}$ per cent.); the silk and sponges are kept in a similar solution until the operation, then placed in $2\frac{1}{2}$ per cent. solution of carbolic acid. The instruments are brushed with a 5 per cent. solution of carbolic acid, and are placed in a $2\frac{1}{2}$ per cent. solution during the operation. Before entering the abdominal cavity the operator covers his hands with a thin layer of a freshly prepared emulsion of iodoform. The chief assistant does the same. The operator and chief assistant have, in their immediate vicinity, a vessel containing a constantly renewed solution of carbolic acid, in order

that the hands may be disinfected repeatedly during protracted, unclean operations.

As a matter of course, the other assistants must avoid the possibility of infecting the patient by their clothes or persons.

But it is going too far to demand that no one present at the operation may have seen a case of acute infectious disease within the week previous. Such a requisite cannot be carried out, and is unnecessary. I only require that the assistant and myself should not have been in any dangerous locality (dissecting room or dead-house) on the day of the operation, and should not have come in contact with patients who harbor infectious matters, which are dangerous to wounds. I therefore operate early in the morning in almost every case.

The abdomen of the patient is washed with a solution of carbolic acid before the operation, and the upper layers of the epidermis removed with the razor; if necessary the pubis is shaved.

The air of the room is disinfected with a large vapor spray of carbolic acid for one to two hours before the operation, but this is discontinued during the operation. I no longer employ the spray upon the field of operation, in order not to expose the operator and chief assistant to the constantly recurring though not severe poisoning with carbolic acid.

CHAPTER XXXI.

GENERAL PLAN OF THE OPERATION.

A SHORT description of the different stages of the operation can only be given for the simplest cases. In the most complicated cases, at least, it is impossible to make general rules for the succession of the various procedures.

After complete narcosis, and cleansing and disinfection of the abdominal integument, the incision is begun in the middle portion of the linea alba. The lower end of the incision remains 5 cm. from the symphysis, because the peritoneum here leaves the abdominal wall to pass to the bladder. The length of the incision depends partly on the size of the tumor, but particularly on the possibility of causing sufficient diminution in the size of the tumor with the aid of the trocar. In cases which appear clinically to be unilocular tumors, and when the abdominal walls are very thin, an incision 6 to 8 cm. in length may suffice. In distinctly multilocular tumors, especially if they do not fluctuate, in very large tumors which will certainly present extensive adhesions, the incision should be at least 15 to 20 cm. in length. Very fat abdominal walls and solid tumors require a disproportionately long incision. If necessary, the incision is carried above the umbilicus, passing a little to its left side. The linea alba must be very carefully kept in view, particularly in nullipara and when the abdominal walls are firm, and hence the skin must not be drawn to one side.

Despite every precaution in such cases, it is often impossible to avoid opening the sheath of one of the recti muscles, which are in close apposition, while these sheaths are not reached in distinct hernia of the linea alba. The skin and panniculus adiposus is now cut with rapid incisions down to the linea alba, where the knife meets with a greater resistance. A sponge is applied to the cut surface for a short time, and we then see whether there are any bleeding vessels which require artery forceps. These are usually veins. Sometimes a number of forceps are required, especially in abundant adipose tissue and oedema of the abdominal walls. It is not until the hemorrhage is checked that an incision is made into the tendinous linea alba, which is first brought more clearly into view by slight scraping movements with the scalpel towards both sides. If the

muscle sheath happens to be opened, we can quickly recognize the edge of the muscle, as a rule, by displacing the slit laterally, and then make a second incision in the right position parallel to the first one.

The transverse striation of the shining transverse fascia is quite often seen distinctly at the base of the *linea alba*. This is followed by the more easily recognized layer of sub-peritoneal cellular tissue, which, on account of its deposit of fat, is rarely overlooked. In some cases the amount of fat in this layer is unusually large, so that we may look upon it as the omentum. If the sub-peritoneal lamina is distinct, we can readily expose a large section of the peritoneum without opening into it. Then the hemorrhage is again checked, and the peritoneum is opened by raising a fold with a hook or forceps. The incision is extended above and below with a curved scissors or blunt-pointed bistoury to the dimensions of the cutaneous incision.

After completing the incision through the abdominal walls the tumor is generally visible, recognizable as ovarian by its white, shining surface. Attention is to be paid to the movements which it makes, corresponding to the respiratory movements. Free movements are a certain indication of the absence of extensive parietal adhesions. With one or two fingers we now explore the entire vicinity of the abdominal wound, in order to ascertain whether there are any parietal adhesions. If present, they are separated over a surface which can be reached by two or four fingers. Omental adhesions, if felt at this stage, are left intact for the present.

If the tumor is adapted to puncture, this is now performed at a place which, if at all possible, corresponds to the main cyst, or at least to a large cyst, and distinctly fluctuates. We avoid all visible vessels of the cyst wall, and forcibly introduce the trocar or open with the knife. In favorable cases the contents escape at once through the tube.

If the cyst is unilocular and parietal adhesions are wanting, the cyst may be gradually drawn out by means of the trocar until, in the most favorable event, it is situated externally, and the pedicle lies in the abdominal wound. We then pass at once to treatment of the pedicle and separation.

In the majority of cases, adhesions or other cysts which have not been emptied prevent the complete protrusion of the tumor. In order to find and separate the adhesions, two fingers or the half hand, freshly disinfected, are passed between the tumor and abdominal walls and separate whatever parietal adhesions can be reached without much difficulty, while the tumor at the same time is fixed externally. With the latter object in view the trocar is removed, when the punctured cyst is evacuated, and the opening first compressed with the fingers, then closed with Nyrop's or Nélaton's forceps. If all the parietal adhesions are divided and the tumor yields to traction, we must note whether the separation of the adhesions has caused any considerable hemorrhage. If so, the abdominal walls are everted as much as possible, in order to discover the source of

hemorrhage and check it. If the hemorrhage is inconsiderable, our attention is directed to the tumor.

Omental adhesions, which are very frequent in large tumors, are separated in front of the wound, not blindly behind the abdominal walls, because they not infrequently give rise to considerable hemorrhage. For this reason they are first ligated, with the exception of very narrow, thread-like adhesions, which may be torn with the finger-nail. In very broad adhesions of the omentum to the tumor the former is removed in part, after double ligature.

If, after separation of the adhesions or in the absence of the latter, the presence of other large cysts is the cause of the incomplete protrusion of the tumor, the further diminution of the size of the latter becomes necessary. This can rarely be done by pushing the trocar, which is still in the tumor, into other cysts or by inserting another smaller trocar through the first puncture opening. Unless the tumor is very large, this deep penetration is not devoid of danger. In addition, we often reach only small cysts, whose evacuation is useless. As a rule, it is advisable to dilate the first opening with the scalpel, so that the hand may enter the cyst. We then perforate the larger septa with the hand, and evacuate the contents through the incision.

If the obstruction caused by the large size of the tumor is overcome, there is usually no further obstacle to its protrusion, since adhesions in the pelvis or to organs, which may fix the cyst, are rarely present, and intestinal adhesions merely permit loops of intestines to follow the tumor.

As soon as possible Martin draws the intestines out of the abdomen and upon the abdominal walls, and has never observed any bad effects from this plan. Such a procedure may facilitate the treatment of adhesions and the toilette in difficult operations, but it is unnecessary in the majority of cases and undoubtedly increases the danger of septic infection and especially the shock.

When the pedicle is free in the abdominal wound, the tumor is placed in such a way that the pedicle does not suffer traction. Any soiling of the abdomen with blood or cyst contents in the vicinity of the wound is superficially removed, and then the pedicle is examined. If this contains only the normal structures, the ovarian ligament, tube and broad ligament, there is nothing to prevent the removal of the tumor. We must then decide on the treatment of the pedicle, and if, as usual, ligature is selected, we must decide in how many parts and at what place the ligatures are to be applied.

When the ligatures are applied and tied as firmly as possible, the tumor is removed with the knife, the assistant holding a sponge underneath to receive the escaping blood. The stump left over in front of the ligatures must be sufficiently long to prevent slipping of the ligatures, especially if only a single one is applied. A larger stump hardly in-

creases the dangers which originate in the pedicle, and it is therefore not advisable to make the stump as short as possible.

The pedicle is rarely so short that insufficient tissue is left in front of the ligature to form a safe stump. In such cases we circumcise the peritoneal covering of the tumor, which is always present in the vicinity of the pedicle, and loosen the base of the tumor with the tips of the fingers from the circumcised part of the peritoneum, in order to preserve the tissues of the pedicle for the stump. If a pedicle is almost entirely wanting, the separation is effected in the tumor itself, all visible cystic formations in the cut surface are destroyed, and the cut surface then cauterized with Pacquelin's apparatus, or, better still, the inner lamella of the remaining part of the tumor is separated blunt. Thus, only the outer, purely connective tissue lamella remains, and from this relapses cannot start on account of the absence of epithelial elements.

The following is the method in cauterization of the pedicle: the cautery clamp is applied, tightened as firmly as possible, and the pedicle then divided with the knife at some distance in front of the instrument. The tissue in front, about $\frac{1}{2}$ cm. in thickness, is now slowly burnt through. It seems as if much importance attaches to the slowness of the cauterization, probably because the entire clamp is then heated to a greater or less extent, and thus a greater part of the pedicle is affected by the heat. This may decidedly favor the coagulation of blood in the vessels. The tissue on the upper side of the clamp is to be cauterized so thoroughly that only a linear strip of carbonized tissue remains visible between the blades of the instrument.

Before removal of the clamp, the pedicle below it is grasped, without traction, by two forceps. Sponges are kept below the clamp (in case of hemorrhage) and the instrument is then opened with extreme caution. If no hemorrhage ensues, the pedicle is released and falls back into the abdomen. We must then avoid touching it or pulling on it. In such cases, therefore, the main part of the peritoneal toilette should be attended to previously.

If removal of the clamp is followed by hemorrhage from a single vessel, Keith passes a needle around it at a certain distance on the central side of the eschar. If the hemorrhage is profuse, and its origin cannot be recognized at once, the clamp is again closed if it had not been removed entirely, or the pedicle is compressed with the fingers, if the instrument had been removed. We must then decide whether another method of treatment of the pedicle is to be adopted. As a rule, this is advisable.

In the clamp treatment, which is now almost abandoned the clamp is at once applied in the position where it is to remain, if the pedicle is free. It is applied as closely as possible to the tumor, but in such a way that the pedicle may be divided between it and the tumor without cutting

the latter. The clamp is screwed up as tightly as possible, and division with the knife performed about $\frac{1}{4}$ cm. in front of the instrument.

The other numerous methods of treatment of the pedicle, chiefly modifications of the three principal methods which have been mentioned, will be discussed in the detailed description of the technique of the operation.

After treatment of the pedicle, we must convince ourselves of the condition of the other ovary. It is easily found, when in its normal position, by passing the finger from the pedicle of the tumor to the uterus, and from the fundus of the latter along the broad ligament of the other side, upon whose posterior wall the ovary is soon recognized. If it is not enlarged and feels firm and cicatricial, it is not brought into view. Otherwise it is drawn out, inasmuch as extirpation may be necessary. If the pedicle is cauterized the second ovary should be examined before removal of the cautery clamp.

This stage is followed by cleansing of the peritoneal cavity—peritoneal toilette. When the operation is absolutely clean, *i.e.*, when cyst contents or blood have not flowed into the abdominal cavity, the toilette is unnecessary, and it may happen in such cases that, if the abdominal incision is short, not a single loop of intestine appears during the entire course of the operation. As a general thing, some blood, at least, flows into the abdomen, and then we must cleanse the parts situated near the incision. If many adhesions, especially deep ones, have been separated, and cyst contents have escaped into the abdominal cavity, thorough cleansing becomes necessary, especially of Douglas's sac, in which, after a prolonged operation, the principal part of the fluids accumulates. Cleansing is effected with sponges which are introduced deeply until they are withdrawn almost perfectly clean, the loops of intestines being spared as much as possible. Special attention must be paid to the endeavor to avoid entanglement of the intestines, so that internal incarceration may not be produced. As a matter of course, the sponges must be cleaned in a disinfectant solution, as soon as withdrawn. If the tumor is large and the adhesions extensive, the renal regions must also be examined and cleaned with sponges. In other cases, special attention must be paid to an extensive and deep vesico-uterine fossa.

But with the antiseptics now employed by almost all operators, the peritoneal toilette has much less influence on the termination of the case than formerly. When only a moderate amount of blood or blood cyst contents has entered the abdominal cavity, it is, therefore, better to confine the toilette to adjacent regions than to manipulate a long time with the fingers and sponges, in the depths of the pelvic cavity and between the individual loops of intestines. This in itself may give rise to infection. But it is especially after very long operations and evident collapse of the patient, that we must ask ourselves whether thorough toilette will

not prove injurious by irritation of the intestines and increase of the shock.

Cleansing of the abdominal cavity is followed by closure of the wound. After clamp treatment the lower angle of the wound remains open; after drainage an opening is left for the tube. In other cases the entire wound is closed. Before beginning suture, a flat, perfectly clean sponge is placed beneath the wound upon the intestines, in order to soak the blood from the suture canals. As the amount of blood is often considerable and cannot be determined in advance, this plan is to be adopted in every case. The majority of operators use a simple interrupted suture and include the peritoneum. Koeberlé's peg-stitch suture, which I have employed in several hundred cases, is advantageous in certain respects. After all the deep sutures are applied, the sponge is removed and the sutures tied. Finally, sufficient superficial sutures are introduced to secure accurate coaptation of the skin.

After the patient is cleaned externally, the dressing is applied. This is either an antiseptic dressing and applied according to general principles, or it is a simple bandage, which is intended to offer a certain protection to the wound, and at the same time to prevent secondary hemorrhage by producing compression of the abdomen. This is done with cotton or antiseptic gauze, which is held in position by a roller bandage or strips of adhesive plaster. When a strictly antiseptic dressing is not used, the wound should be dusted with iodoform, in order to prevent decomposition of the secretions from the suture canals.

After the patient has been dressed in dry clothes, she is carried to bed.

The time required to perform ovariectomy varies greatly according to the difficulty of the case, and also according to the operator. When A. Martin says that he performs a simple ovariectomy in seven and a half minutes, a difficult one in, at the most, twenty minutes, the first statement is conceivable, the second one is entirely inconceivable to us. We confess that we require a much longer time. In sixty successive ovariectomies, in which, it is true, there were unusually many difficult ones, the average duration (from the first incision to the last suture) was fifty-four minutes, the shortest period twenty minutes, the longest period ninety-five minutes. Keith and other skillful operators have required one and a half or even two hours for performing difficult operations.

CHAPTER XXXII.

DETAILS OF THE OPERATION.

THE INCISION THROUGH THE ABDOMINAL WALLS.

THE various stages of the operation receive numerous modifications, partly on account of the differences in the cases, partly on account of the peculiar methods of individual operators.

The incision through the abdominal walls was formerly made in various positions, but Spencer Wells, like the majority of operators, has never made it otherwise than in the *linea alba*. A lateral incision, apart from the greater hemorrhage, is not to be recommended, because the diagnosis of the side on which the tumor is situated is usually uncertain, and in case of error, treatment of the pedicle is more inconvenient if the incision is not in the median line.

Length of the Incision.—The so-called free incision of former times is said to have been attended with a much greater mortality. But it is a question whether the greater mortality was not due to the difficult conditions of the operation rather than to the length of the incision. With strict antiseptis, at all events, the length of the incision exerts no notable influence on the result of the operation. Hence, the incision should not be made too small. If extensive or inaccessible adhesions or other obscure conditions render it desirable, we should not hesitate to enlarge the opening, even considerably above the umbilicus. We often gain thereby in time, and, what is more important, in the certainty of operation.

As a rule, the hemorrhage from the abdominal walls is checked without difficulty. It is only in marked oedema that the gaping veins usually bleed longer; the arteries of the recti muscles, if cut, may also bleed more profusely. In exceptional cases ten to fifteen forceps may be necessary for the abdominal walls, but the majority may be removed in a little while.

In one case Kimball could not check the capillary hemorrhage from the abdominal walls, and was therefore compelled, in closing the abdomen, to evert the abdominal walls and to unite them upon the peritoneal surface, below the surface of the wound.

It is important to incise the *linea alba* accurately, in order to avoid opening the sheath of the rectus. By carrying the knife along the pigmented line of the skin, this may often be done, even in those cases in

which the interspace between the inner edges of the recti is very narrow. In nullipara, however, we can rarely avoid opening the sheath. If this has happened, we must endeavor to find the border of the muscle and the linea alba by pushing the tissues to one side.

In continuing the incision we will not always be able to distinguish the transverse fascia by the course of its fibres. After it is cut, however, the fat-containing præperitoneal lamina almost always appears distinctly. In rare cases it resembles the omentum, on account of the unusual amount of fat. We are more apt to cut through the peritoneum unwittingly, and to mistake the omentum for the sub-peritoneal cellular tissue until the extent of the layer of fat, the size of individual clumps of fat, and the abundance of vessels reveal the mistake. We may also be aided by the direction of the vessels which usually run transversely in the præperitoneal lamina and longitudinally in the omentum.

If ascites is present in considerable amount, and is collected in front of the tumor, the peritoneum usually projects considerably, as soon as exposed. This may simulate the cyst, and in the belief that the latter is adherent to the abdominal walls, the peritoneum may be separated from the abdominal walls over a large area. Whoever has seen several cases of protrusion of the peritoneum by ascites will not be easily deceived, because the peritoneum is thinner, darker and more vascular than the cyst-wall, but particularly because a circularly adherent cyst-wall will not project to such a marked degree into the wound. The best guide for avoiding a mistake is the præperitoneal layer, which is distinct and easily recognized in the majority of cases, and to which, therefore, special attention should be paid.

When the real condition is recognized, the peritoneum is incised and the ascites allowed to escape. Peaslee allowed only a part of the ascitic fluid to escape, and then directed the assistant to push the tumor into the wound, and thus cut off the escape of fluid. The remaining fluid was intended to prevent soiling of the intestines. This notion is not erroneous, but is carried out with difficulty. The wound cannot be kept closed while diminishing the size of the tumor, and especially while separating adhesions. The constantly escaping ascites interferes with our view of the field of operation and with our recognition of hemorrhages. Hence peritoneal dropsy should be evacuated as completely as possible, before attacking the tumor. Complete evacuation, however, is impossible, whether during or after the operation.

In enlarging the incision after the peritoneum is opened, an accident can rarely happen to a careful operator. But the intestines are sometimes situated between the tumor and abdominal wall, and may suffer injury. Heath reports a case in which, during dilatation with scissors, a loop of intestines, situated in front of the tumor, was cut three-quarters through. The patient recovered, but an intestinal fistula remained.

CHAPTER XXXIII.

TREATMENT OF ADHESIONS.

AMONG 280 successive ovariectomies and parovariectomies, I found the following adhesions: parietal eighty-one, omental sixty-nine, intestinal forty-four; to the floor of the pelvis or the broad ligaments, twenty-four; to the mesentery, nine; to the bladder, five; to the uterus, three; to the appendices epiploicæ, two; to the vermiform appendix, seven; to the iliac fossa, two. An unusually large number (fifty-three) of these tumors were more or less subserous, and the close approximation or connection of such extra-peritoneal parts of the tumors to the uterus, rectum, etc., were not included under the head of adhesions.

In the foregoing cases there were parietal adhesions in 29 per cent., omental adhesions in 25 per cent., and intestinal adhesions in 16 per cent. of the cases.

It is a general principle that parietal adhesions are to be separated before the evacuation of the tumor, with the aid of the feel, the others as much as possible with the aid of the sense of sight. It is much easier to separate the parietal adhesions when the tumor is full. The hand, with the palm directed towards the tumor, is passed between the latter and the abdominal walls, and the separation is effected by stroking movements with the tips of the fingers and the ulnar border. But this plan also possesses disadvantages. If the adhesions are very vascular hemorrhage ensues, and when the tumor is still tense, it is as difficult to determine its origin as it is to check it under such circumstances. I have seen enormously dilated veins, such as are found occasionally in these adhesions, torn blindly, and the hemorrhage uncontrollable until partial evacuation of the tumor. If the adhesions are extensive and separation is performed as far as possible, we will often reach a free part of the surface. The bleeding surface is thus connected with the peritoneal cavity, and the latter is, therefore, soiled unnecessarily.

Finally, separation of the adhesions not infrequently gives rise to rupture of the outer wall of the tumor in one or more places, and this results in further unavoidable soiling of the peritoneum with the cyst contents. Even if the tumor has been partly emptied, this accident cannot be prevented with certainty, but it usually occurs to a more limited

extent, because the cyst cavities have already ruptured internally, or will rupture in this direction.

For these reasons extensive adhesions to the abdominal walls should first be separated only to a limited extent, about as far as can be reached by four fingers, and then the tumor should be at least partially evacuated. This is followed either by separation of the parietal adhesions, or by the further evacuation of the cyst, according as the one or the other appears to be an obstruction to the removal of the tumor. The origin of any considerable hemorrhage during the separation of adhesions may then be ascertained by everting or lifting the abdominal walls, and may be treated as necessity demands.

It is in great part a mere prejudice to believe that the separation of adhesions becomes difficult after partial evacuation of the tumor. When tension of the sac is produced by vigorous traction, the separation with the hand is equally easy and very little slower. The finger tips are then mainly employed in separation. The degree of force required and the hemorrhage produced vary exceedingly. There are cases in which the separation of the adhesions requires the exercise of considerable force. We generally find continuous surface adhesions; in other cases there are dozens and hundreds of bands, often tendinous and unusually firm. Some parts can only be divided with the knife.

Péan employs the following method in firm adhesions: when the adhesion is firm and circumscribed, he perforates the cyst-wall, 3 or 4 cm. from the adhesion, with a straight, strong metallic needle, which is passed beneath the adhesion, and then again out through the cyst-wall. He then surrounds the cyst-wall, below the needle, with a strong thread, and then divides with the knife between the needle and the adhesion. The ligature is prevented from slipping by the needle, and prevents the escape of cyst contents.

Slight, fresh adhesions do not bleed more than tendinous ones, but in exceptional cases we find surfaces which bleed considerably. This may be checked by compression, the actual cautery or the application of liq. ferri sesquichl. In large tumors which extend to the scrobiculus cordis, the entire absence of parietal adhesions is rare, and can only be expected when the growth has been rapid. In the worst cases the adherent surface of the tumor is measured by square feet.

As the parietal adhesions form preferably at the most prominent part of the tumor, it is not uncommon that it is firmly adherent around the incision. If the peritoneum and surface of the tumor are recognized with certainty, we proceed in the manner described above. But if there is the slightest doubt as to the various layers of the cut surface, the incision must be prolonged above, or an incision is made into the cyst, and the possibility of separating the peritoneum instead of the cyst-wall is thus avoided. The former plan is especially advisable when the abdominal

incision is near the upper end of the tumor, or if ascites, which is demonstrable immediately above the wound, leads us to expect that we will soon come in contact with the free surface.

The difficulty of recognizing the surface of the cyst may be very great in inflammatory thickenings of the peritoneum, and in some cases it is impossible. The subperitoneal fatty layer, when visible, is the surest guide.

If an incision has been made into the cyst, the differentiation of the layers is made much more easily. And if the tumor has collapsed somewhat, the separation not infrequently begins spontaneously in the incised wound, because the cyst separates by its own weight.

In a case of intimate parietal adhesion in which the peritoneum could not be found, B. S. Schultze employed a peculiar method. He entered the widely opened cyst, grasped a fold of the anterior wall of the tumor, placed the fingers behind, and, with the tips of the fingers directed forwards, pushed the fold between the adherent part of the cyst wall and the abdominal wall. He thus slowly separated the adhesions by the exercise of considerable force, until the cyst wall appeared in the upper angle of the wound.

Despite every precaution, it has probably happened to every one, who has had many difficult cases, to have separated the peritoneum in part, and to have been unaware of the error until later. The great ease with which even the thickened and still more the normal peritoneum, despite its complete adhesion, may be separated from the abdominal walls, is especially calculated to arouse our suspicions. Accurate examination of the inner surface of the abdominal wall at the point of separation usually removes every doubt.

Very circumscribed separation of the peritoneum possesses no significance; when more considerable it must be stitched to the abdominal walls before closure of the wound. This is best done with a continuous catgut suture or the so-called mattress suture. A firm bandage is also useful in pressing the loosened peritoneum against the abdominal wall. If the separation is confined to the vicinity of the abdominal wound, it is merely necessary to include the peritoneum freely in closing the wound.

Omental adhesions are next in frequency to the parietal form, and like these, become visible before the complete evacuation of the tumor. If the omentum is found while making the abdominal incision, we should attempt to reach the tumor in the lower part of the wound. If the omentum is also met with here, it is not advisable to prolong the incision downwards, since the omentum may be situated in front of the tumor even within the pelvis. If the omentum is adherent to the abdominal walls, it should be carefully separated from it, so that we can reach the free surface of the tumor laterally, and if necessary for this purpose, the incision may be prolonged above. As a rule, it is not advisable to cut through the omentum itself in order to reach the tumor, on account of

the hemorrhage produced thereby. In some cases, however, this is the simplest method.

As a rule, the omentum is found above the umbilicus, so that it can be felt by the exploring hand in the first examination after the abdominal incision is completed, but it does not become visible until the tumor is partly evacuated. If the soft mass of the omentum is felt in separating parietal adhesions, it should be let alone until it can be drawn out, inasmuch as omental adhesions are so vascular that they should be provided with ligatures before they are cut. If they assume the form of bands, they may be separated with the finger-nail. When the omentum adheres very firmly to the tumor over a large surface, or presents a striking development of large vessels, double ligatures should be applied and the incision made between them.

The adherent omentum varies extremely in shape. It may form a broad, fatty, voluminous membrane, or it is divided into numerous bands which only remain connected above, or it is rolled into a thick round cord.

It is connected most frequently with the anterior surface of the tumor, but also often with its posterior surface. In other cases we find separate parts of the omentum on both sides of the tumor, or it is adherent anteriorly and then extends to the pelvis, where its lower extremity is united to the bladder or to a part of the floor of the pelvis, or, finally, it leaves the anterior wall of the tumor to adhere to the abdominal walls.

The application of the ligatures varies according to the course and thickness of the adherent portions. The matter is facilitated by first ligaturing as high up as possible, before the omentum has divided into different bands.

Unless there is only a single thin band, the ligatures must always be applied in several parts, because a single silk or catgut ligature will not securely ligate the entire width of the omentum. If rubber is employed fewer ligatures are necessary, and a single rubber ligature will often be as safe as four silk ligatures.

A very peculiar appearance is presented by the large veins (always starting from the omentum), which often course free through the abdominal cavity for one or even two finger lengths, and pass to the abdominal walls, the pelvis or other parts. They are easily torn during manipulation. Double ligatures should be applied and the vessel cut between them.

The application of ligatures *en masse* is the only proper method of checking hemorrhage in the treatment of omental adhesions. All parts of the omentum, which have been handled, should be washed thoroughly with a solution of carbolic acid ($2\frac{1}{2}$ per cent.) before they are replaced.

Mesenteric and intestinal adhesions form an extremely disagreeable complication. Fortunately they are not very frequent, and are hardly ever found in front of the tumor, but become visible, on withdrawal of the tumor, upon its posterior or lateral walls. They require the most

careful treatment, as they are usually very vascular, and the loops of intestines may not be subjected to the pressure of the nails or to vigorous traction. When the connection of the loops of intestines with the tumor is not very intimate, but is effected by means of bands or membranous structures, we divide the adhesion after ligature towards the side of the intestine or towards both sides. But if this cannot be done on account of the lack of space, and the adhesion cannot be separated by gentle traction, it is better to divide it with cutting instruments within the wall of the tumor. Adhesions which require this method are generally very circumscribed, but in one case Atlee was compelled to leave a piece of the cyst wall, 20 to 24 cm. long, attached to the transverse colon. In another case he found several feet of intestines so intimately adherent to the cyst-wall, that he left the latter behind over the entire extent of the adhesion, but subsequently deprived it of its epithelial inner surface. A more rational, usually simpler method, and above all, a more certain protection against relapses, is the following method which I have devised: the portion of the cyst-wall, which is firmly adherent to the intestine, is circumcised from without, the cyst opened at this point, if necessary, and the inner layer, within the circumcision, removed blunt from the external, usually first layer of the cyst-wall. As a rule, the separation is not difficult, and the retention of the external layer alone is a sufficient safeguard against relapses.

The danger of extensive intestinal adhesions is evident from the numerous cases of intestinal fistula after ovariectomy. These cases are the result in part of direct injuries to the intestinal wall or the serous layer alone, in part of the pressure of ligature knots, which were situated close to the intestine. Billroth has seen two cases of the latter variety.

It may be very difficult to recognize the position or even the presence or absence of a loop of intestine when the adhesions are extensive. This difficulty is especially pronounced when, as is not uncommon, a loop is adherent to the pedicle. If the pedicle is unusually broad, the portion of the broad ligament which forms part of the pedicle may look very much like the intestine. This resemblance becomes still greater when the pedicle is compressed by a ligature, in consequence of which the parts on both sides distend like cysts. Whoever has not seen this phenomenon may think that a loop of the intestine has been included in the ligature. The most certain opinion is gained in such cases by looking at the parts in transmitted light. But this is not always possible, and it then only remains to follow the parts farther, and to determine their connection with the gut, or their isolation. When the adhesions are very broad and intimate, even the most skillful operator may injure the serous lining of the gut, or the entire intestinal wall. If the intestine is deprived of peritoneum over any notable extent of surface, it must be covered, with the finest needles, by peritoneum from adjacent parts. If the

intestinal wall is injured, intestinal sutures must be introduced, and, if necessary, the gut must be resected.

Spencer Wells was compelled to resort to intestinal sutures in two cases, and in a third case resected 8 cm. of the intestines. I have injured the serous lining of the gut in several of my earlier cases, but never the intestinal wall. One case, which I formerly reported as one of injury to the gut, I now interpret in another way. The operation was performed on a woman five months after delivery; increased size of abdomen for past three and a half months; moderate fever. On account of the absence of peritonitic symptoms the fever was attributed to suppuration of the cyst. The operation showed a gangrenous dermoid cyst, and double torsion of the pedicle. The tumor was totally adherent. The gut was adherent on its posterior side, and about two metres of intestines were separated after one and one half hour's laborious work. A round opening, as large as the tip of the little finger, then appeared in the wall of the intestine. The edges of the opening and the mucous membrane were somewhat everted. It did not look like a fresh wound, and I have long had no doubt that the connection of the phenomena was as follows: torsion of the pedicle, diffuse peritonitis and broad adhesion of the intestine to the tumor; then perforation of the gut and gangrene of the tumor. The patient died of sepsis on the third day. The case shows that in separating firm intestinal adhesions we must always think of the possibility of intestino-cystic fistula. This is especially true of gangrenous tumors and when diarrhoea or escape of ichorous cyst fluid through the rectum has been noticed. However, no similar case has been reported to my knowledge.

Adhesions to the vermiform appendix are not very rare; seven cases have come under my observation. In several cases its entire width was adherent, and its separation was effected with difficulty.

In a case of ovarian cancer Schroeder was compelled to remove the adherent and carcinomatous appendix. The patient recovered.

As a rule, mesenteric adhesions should be separated after ligature, or they are first separated and then ligatured if necessary.

The following interesting case of extensive adhesion of the mesentery may be here reported:

Mrs. S., aged fifty-four years, multipara, has not menstruated in five years, but repeated hemorrhages per vaginam during past five weeks; cognizant of an abdominal tumor only during last two months.

The tumor extends 8 cm. above the umbilicus and is unusually broad. No prominences on its surface; resistance distinctly elastic, firmer in one part: no fluctuation. Extensive tympanitic percussion on right side, reaching anteriorly to middle of crest of ilium. In other parts dullness on percussion. No changes in percussion on change of position; very slight mobility of tumor. Tumor could not be felt by vaginal examination, but the latter revealed a fibroma, as large as the fist, at the cervix uteri.

Operation on February 19th, 1876. Small quantity of ascitic fluid escapes after cutting the peritoneum. The exposed tumor has a brownish red color like a pregnant uterus. No parietal adhesions to be felt. On the left side below the wound the presenting structures are found to terminate in a free edge, directed outward and downwards, and which therefore constitutes a thick membrane applied to the tumor. The free edge merely lay on the tumor for a distance of 2 to

3 cm; beyond this the membrane and tumor were generally adherent. I succeeded in moving the tumor in such a way that the white free surface was drawn into the wound from below and the left side, and could be punctured. After evacuation of the main cyst the tumor did not yield to traction, although two cysts as large as a fist and a few smaller ones alone remained.

On examination of the reddish brown membrane over the tumor (the end of the membrane could not be reached above or to the right) it was found to contain an entirely collapsed loop of intestine, which runs across the anterior surface of the tumor and is entirely adherent for about 25 to 30 cm. In front of it the thick membrane is adherent generally over a surface about 2 cm. wide, and then terminates in a loosely applied fold of about the same width. Above the intestine the membrane was totally adherent. The following schematic figure illustrates the relations of the parts.

The separation of the mesentery was now begun anteriorly, at first remaining close to the surface of the tumor; this was followed by considerable hemorrhage. I then kept closer to the membrane (the mesentery) and with great difficulty separated the entire loop of intestine and the mesentery behind it. On the right



FIG. 29.—OVARIAN TUMOR BROADLY ADHERENT TO THE MESENTERY. *T*, Tumor; *D*, intestine; *M*, mesentery; *Fr R*, its free border.

side, the mesentery, after it had been separated to a width of 6 to 8 cm. became very thin and tore through, so that the tumor was here free. A broad intestinal adhesion, which was situated still further to the right, was ligated and divided with the knife. On the left side the mesentery was still thick and firmly adherent and the end was not yet to be seen. About fifteen ligatures had been applied to bleeding vessels, and it became imperatively necessary to finish the operation. I concluded to ligate in parts and then divide the mesentery which was still adherent for about 15 cm. This was done in three divisions, and the intestine was thus deprived of mesentery in this region.

The tumor was now free. The pedicle, which still presented intestinal adhesions, was divided in front of these, ligated with catgut, and restored. Drainage through the vagina was then carried out.

After closure of the abdominal wound a dressing was not applied on account of the drainage, but irrigations were used vigorously. A good deal of bloody fluid escaped at the start.

The condition of the patient was not unsatisfactory. The temperature rose to 39° on the same day, and pulse to 104, but both fell on the next day. Renewed fever and distinct symptoms of peritonitis on the third day to fifth day; a round, painful swelling, as large as two fists, formed in the left hypogastric region, projecting out of the pelvis but not touching the abdominal walls. On the sixth day

the left half of the vulva became acutely œdematous. The peritonitic symptoms subsided, although the patient was not free from fever. On the eighth day there was an attack of vertigo, syncope, and oppression with cold limbs and thready pulse, symptoms which were attributed to embolism of the pulmonary artery. The attack subsided in a few hours and the patient became warmer. The drainage tube was removed on the ninth day, and at the close of the twelfth day a second similar attack occurred, to which the patient succumbed.

The autopsy showed that the swelling on the left side was a gangrenous focus, whose upper walls were formed by the omentum, sigmoid flexure and loops of small intestines. These parts, which were firmly adherent to the uterus and to one another, formed a complete capsule. The walls of the intestine, which were deprived of mesentery, did not look abnormal.

Both pulmonary arteries contained large though not entirely occluding emboli, with a firm nucleus. The source of the emboli could not be ascertained.

Remarks. There is no doubt that the thick reddish-brown membrane, which lay upon the tumor, was the mesentery. That the mesentery was situated not alone on one side of the intestine, posteriorly, but was also applied to the tumor in front of the intestine over a part 4 to 5 cm. wide, can only be explained in the following way: the tumor must have become adherent to the mesentery at an early period, and the latter was unusually distended by the growth of the tumor. At the same time the two layers of the mesentery were displaced in such a way that the one which was directly adherent to the tumor grew forwards with the latter, beneath the loop of intestine.

When I decided upon removing a portion of the mesentery 15 cm. in length, the question naturally arose whether this might not result in gangrene of the intestine. After a few days I was relieved on this score. The investigations of Cohnheim and Litten¹ had hardly been published. They say with regard to separation of the intestine from the mesentery: "All the arteries passing from the mesentery to a portion of intestine 8 to 10 cm. long may be ligated, and, although the loop of intestine in question can then be supplied only by those arteries which are situated in the intestinal walls themselves,—nevertheless self-injection at the end of an hour or even less shows as marked fullness of the vessels in this loop as in the rest of the intestines." These statements are made concerning rabbits. It is evident from the foregoing clinical history that the conditions must be similar in the human intestines and that in similar cases we may, without fear, ligate at least small portions of the mesentery. I have done this in a second case (*vide* Chap. 36) and gangrene of the intestine did not result. For this reason I believe that Madelung and Czerny's warning not to leave a portion of intestine a few centimetres long without mesentery is unwarranted.

The presence of a loop of intestine about 30 cm. long on the anterior surface of the tumor is a not very frequent occurrence. Spencer Wells mentions it only once among his first 114 cases. In his first case of exploratory incision he found the tumor behind the intestine, was therefore in doubt concerning the nature of the growth, and did not perform the operation. Death occurred at the end of four months, and the tumor was found to be ovarian.

The fatal termination by pulmonary embolism occurs occasionally after ovariectomy. This diagnosis was made especially probable in our case by the occurrence, a few days before, of acute, unilateral œdema of the vulva which allowed us, with tolerable certainty, to infer an extensive thrombosis of the pelvic veins.

¹ Ueber die Folgen der Embolie der Lungenarterie. Virch. Arch. Bd. 65, I. p. 99.

Among the noteworthy adhesions to other viscera are those to the liver, spleen, uterus and bladder, the latter being the most frequent. Splenic adhesions require great caution on account of the considerable hemorrhage which occurs when the spleen is torn; hepatic adhesions must be carefully treated when near the gall bladder. Their separation must first be attempted with the finger, and if this is unsuccessful, the knife or scissors is used. If necessary, they must be divided in the tumor itself.

Uterine adhesions are usually very extensive; they are most frequent upon the posterior wall. They occur chiefly in tumors which extend in great part to the floor of Douglas's sac, where they are totally adherent. The pelvic adhesions are then more important and more difficult to treat than the uterine adhesions. The latter are almost always very broad and intimate, so that ligatures cannot be used either before or after separation.

Adhesions to the bladder are dangerous from the fact that this organ is apt to be unrecognized, and may even be mistaken for a part of the tumor. This is especially apt to occur when the bladder is broadly adherent to the tumor, and is drawn up very high. In order to avoid this accident it is much better not to empty the bladder completely before the operation. The separation of the adhesions is not always easy, but bleeding vessels in the raw surface are ligated better than in uterine and most intestinal adhesions.

Adhesions to the floor of the pelvis are among the most serious. The difficulties reside in the deep position of the field of operation, often in the impossibility of receiving aid from the sense of sight, the width of the surfaces of adhesion, the difficulty in checking the hemorrhage, the possible injury of large vessels and of the ureters.

As a rule, we have a choice between two methods alone, separation with the hand aided by the feel, or the removal of the walls of the tumor above the adherent places. Or perhaps the operation must be left unfinished, the cyst-wall being stitched into the abdominal wound.

The force employed in separation by the hand and the extent to which it may be directed, must be left to the experience and judgment of the operator. It can only be said in general, that, when the tumor need not be separated from the intestines, considerable force may and must often be employed.

The removal of the tumor above the adherent places is effected after constriction of the walls of the tumor in parts, by means of ligatures. If the tumor is not very vascular, the use of ligatures *en masse* may be superfluous, and we may confine ourselves to individual ligatures to the parts which bleed after the removal of the tumor.

Whether it is better to leave a portion of the tumor in the pelvis, or to stitch the wall of the tumor to the abdominal walls and drain the sac,

will be discussed in a subsequent chapter. I will merely state here that I am a determined opponent of the latter method.

The following remarks may be made concerning the checking of hemorrhage from divided adhesions. When large vessels are visible, they should receive a double ligature before division. This is most frequently possible in omental adhesions, and in veins which run isolated through the abdominal cavity, and, as a rule, are derived from the omentum. Even in parietal and other adhesions the previous ligature of individual, large vessels is often necessary.

When hemorrhage occurs after division, ligature is the best remedy. But this cannot be employed when the hemorrhage is capillary, as often occurs from the abdominal walls, intestines, uterus, etc. Nor can ligatures be employed when the bleeding vessels are situated upon the smooth surface of the abdominal walls or firm viscera, such as the liver and uterus; upon the intestinal walls, also, the use of ligatures is rarely possible. If the capillary hemorrhage is not very marked, it may often be moderated considerably by compression with the sponge, and after a time, we often become convinced that nothing further is necessary.

Pacquelin's cautery is very useful in solid organs, especially the uterus and abdominal walls, but the heat must be allowed to act for quite a long time in order to be effective. Hegar has even used a feebly glowing thermo-cautery in close proximity in hemorrhages from the intestinal walls.

The English and Americans not infrequently use sulphate of iron for the same organs, and also for the abdominal walls, omentum and other surfaces from which capillary hemorrhages occur. The tip of the finger, moistened with a concentrated solution of the salt, is applied to the bleeding surface and rubbed to and fro.

Hemorrhages from the broad ligaments or the floor of the pelvis are best checked by ligatures of the tissues.

Spencer Wells adopts the following plan in hemorrhages from the abdominal walls which are not susceptible of ligature. By compression with the finger which surrounds the bleeding spot, he ascertains from which side the main vessel comes. When this is clear, the vessel is compressed by a loop which is passed from within, at two points some distance from one another, and tied upon the abdominal walls. Acupressure has also been employed for this purpose; a Carlsbad needle is passed from without through the abdominal walls, carried beneath the bleeding vessel on the peritoneal surface, and then passed out externally. If the thermo-cautery proves useless and the bleeding surface on the abdominal walls is large, the surfaces may be compressed against one another by mattress sutures, which are tied upon the abdominal walls. These sutures are loosened at the end of twenty-four hours, unless they are catgut and are left to be absorbed.

The material selected for the ligatures is immaterial, provided it is thoroughly disinfected. Silk ligatures often gave rise to suppuration formerly, but this need not be feared with silk, which is first boiled in carbolic acid (5 per cent.) and then kept in corrosive sublimate ($\frac{1}{10}$ per cent.). If raw catgut is prepared by placing it in sublimate ($\frac{1}{10}$ per cent.) and is then kept in alcohol, certain antiseptis is secured.

Three knots should always be tied in catgut ligature, also in silk ligatures around large vessels, and in ligatures *en masse*. After infiltration with fluid, the knots slip much more easily than is generally believed.

Bleeding vessels in the tumor itself often require ligature, or, if this is impossible, the application of a ligature *en masse*, until the radical method of checking such hemorrhages, *viz.*, by a ligature of the pedicle, can be carried out.

CHAPTER XXXIV.

DIMINUTION OF THE SIZE OF THE TUMOR.

THIS is done most conveniently with the trocar, but only when at least one larger cavity is present, when the contents are fluid and the main wall of the tumor is not too brittle. The trocar is introduced in a part which is free from larger vessels. If the evacuation of one cyst is insufficient and other large cysts are recognizable externally, the trocar is pushed from the first one into the others. When this does not seem probable without risk of producing injury, we incise the punctured cyst, and then other cysts projecting on its inner wall, or we may tear the intervening septa with the tips of the fingers. If the puncture or incision has not been too large, it is well, for the sake of cleanliness, to close it with broad forceps or sutures, in order to prevent the further escape of fluid.

In some cases the trocar does not act on account of the jelly-like, non-fluid colloid masses or clots of fibrin, or finally, the masses of hair and fat in dermoid cysts. In other cases its action fails on account of the brittle walls of the tumor which rupture widely, or of the small cyst character of the tumor.

In the majority of such cases the best plan consists of broad incision of the cyst-wall, destruction of the septa and removal of the tough contents with the hand. This method is also suitable for shortening the operation in cases in which otherwise the trocar may be used. Schroeder rarely employs the trocar. This method does not increase cleanliness, but if the contents of the tumor are bland, the danger is not increased.

But whenever purulent or gangrenous contents of the tumor are found or are probably present, and in all cases of dermoid cysts, whenever possible, we should avoid making an opening altogether, and should attempt to remove the tumor, undiminished in size, by enlarging the abdominal incision. If the tumor has been opened, but its contents did not escape, the opening should be drawn as far as possible in front of the abdominal walls, and closed with sutures.

Considerable or even dangerous hemorrhage occurs in rare cases from rupture of numerous internal cyst-walls. This may happen in tumors whose individual cysts possess very delicate membranes. The only hope then consists in the rapid search for and ligature of the pedicle.

Great fragility of the tumor walls, parvilocular character of a cystoma, tough, jelly-like consistence of the contents, formerly gave rise to great difficulties, and often caused the operation to be left unfinished; the uncleanliness, which is often unavoidable in such cases, endangered the life of the patient, despite the most careful peritoneal toilette. At the present time we are masters of the situation, and need hardly fear soiling of the abdominal cavity with colloid masses as a source of sepsis.

It is best to avoid diminution of solid tumors. On the other hand, they require a considerably longer abdominal incision. If, in exceptional cases, the diminution appears necessary, it is best to remove the blood from the parts which are to be excised by the application of a rubber tube. As a matter of course, this does not refer to constriction of the pedicle, inasmuch as the tumor, as a rule, must have been drawn in front of the abdominal walls before this can be done. If the rubber tube cannot be employed, on account of the shape of the tumor, the parts to be removed must first be deprived of blood by encircling them with wire (*morcellement*)

The withdrawal of the tumor from the abdominal cavity, after it has been sufficiently diminished in size and freed from parietal adhesions, is generally unattended with difficulty. If the tumor cannot be drawn out, through the perhaps narrow opening, by means of the hand or Nyrop's forceps, the entire hand is inserted into the tumor, or the firm, inner septa are seized for purposes of traction.

In clinically unilocular tumors, whose removal cannot be effected despite the most complete diminution possible, it has been recommended to seize the posterior wall of the cyst from within, to invert it towards the cyst cavity, and to withdraw it in this way. Nussbaum employed this method, in one case with favorable, in another with fatal results. Very few cases indeed are adapted to such a procedure, and the greatest caution is always necessary, since we can never tell what parts will be removed with the tumor, or what adhesions will be torn.

It is always better to ascertain the obstruction to removal, by passing the hand around the posterior wall of the tumor. It may be the result of adhesions posteriorly (to the spinal column, kidneys, etc.), pelvic adhesions, impaction of a part of the tumor in the pelvis, or secondary, previously unrecognized cysts, whose size acts as an obstruction.

CHAPTER XXXV.

THE PEDICLE AND ITS TREATMENT.

ANATOMY OF THE PEDICLE.

WERTH gives the best description of the anatomy of the pedicle.

The upper border of the broad ligament contains, as is well known, the Fallopian tube, but the latter perforates the ligament before it reaches the rim of the pelvis. A lateral portion of the ligament, the infundibulo-pelvic ligament, is thus left over. From the posterior layer of the ligament rises a secondary fold. This receives the ovary in its middle portion (mesovarium). The median part includes the ovarian ligament, the lateral forms the infundibulo-ovarian ligament. The latter abandons its horizontal direction and ascends obliquely to the infundibulo-pelvic ligament, meeting the latter at an acute angle.

If the ovary is considerably enlarged and its hilus becomes broader, the lateral portions of the secondary fold of the broad ligament, *i.e.*, the ovarian and infundibulo-ovarian ligaments, are separated from one another and describe an arch, although they had previously run a straight course.

The formation of a pedicle depends partly on hyperplastic processes in the ligaments of the ovary, partly on the effects of traction. The mesovarium necessarily passes first into the pedicle. After further traction the ovarian and infundibulo-ovarian ligaments are drawn up upon the tumor, and since the latter ligament carries the fimbria ovarica, their base is now situated upon the tumor instead of the subserous connective tissue, as heretofore. This position of the fimbria also induces closer relations of the tube funnel to the tumor. This occurs still more, when, during the further course of the disease, the adjacent fold of the infundibulo-pelvic ligament is drawn upon the ovarian tumor. Finally, this may also happen to the extreme lateral portion of the tubal ampulla, so that it is closely applied to the tumor. The greater part of the tube, however, is separated from the tumor by the mesosalpinx.

The anterior peritoneal layer of the broad ligament does not take part in the formation of the pedicle. The portions of the ligament, which are included in the pedicle, belong to the posterior layer and its secondary fold.

The pedicle is changed somewhat during the operation by the traction

on the tumor. While the mesovarium and infundibulo-ovarian and ovarian ligaments necessarily form part of the pedicle, this is not always true of the tube, or, at the most, of its fimbriated extremity. But as the separation of the tumor from the tube in the long, narrow mesosalpinx would be attended with technical difficulties, the operator almost always includes in the pedicle a section of the tube from 4 to 12 cm. long or more. The division is effected closer to the border of the uterus than the formation of the pedicle proper renders necessary.

Hence, the pedicle almost always includes the ovarian ligament, the tube, and a more or less broad portion of the broad ligament. The ovarian ligament often is not inconsiderably thickened (two to four-fold); more rarely it is atrophic and almost obliterated. The broad ligament may also undergo a certain degree of hyperplasia.

The length of the pedicle is very variable. In the majority of cases it is at least 3 to 4 cm., so that it can always be tied *en masse* without difficulty, and may be divided outside of the tumor, while leaving a broad mass of tissue behind. In rare cases the pedicle is 10 or even 15 cm. long. It is then usually round and narrow.

The breadth of the pedicle is also extremely variable, (a few centimeters to 12 centimeters). It depends almost exclusively on the part taken by the broad ligament. A moderate breadth and length are most frequent. Unusually broad pedicles are generally very short. They are found ordinarily in solid tumors, but exceptionally in cystomata.

The vessels enter the pedicle from two sides, the most numerous and largest ones entering from the outer side through the infundibulo-pelvic ligament. These are the spermatic vessels. Branches of the uterine artery and the corresponding veins enter from the uterine side. According to Bryant, short, thick pedicles generally contain small vessels; narrow pedicles often contain large vessels. The median portion of the pedicle (derived from the broad ligament) not infrequently contains bundles of large veins, resembling earth-worms. A twisted pedicle may be almost or entirely devoid of vessels if the torsion has been considerable and has been attended with notable circulatory disturbances. In recent cases all the vessels are often found filled with thrombi; in older cases the pedicle becomes brittle, and the lumina of the vessels are no longer recognizable.

In rare cases the pedicle becomes double from atrophy of the parts composing it. One part then contains the tube, the other the ovarian ligament; each contains the broad ligament in part. But Werth describes a form of division in which the tube and ovarian ligament form one half, the infundibulo-pelvic ligament the other half.

It is an entirely different matter when an ovarian tumor receives the uterine appendages of both sides, which form pedicles coming from each side. The second pedicle then consists merely of the tube of the other side and a part of the broad ligament, which have become adherent to

the tumor and which may be buried in a furrow upon the tumor. I have twice seen this anomaly.

Knowsley Thornton mentions four cases. The anomaly is not without practical importance, because it interferes with our recognition of the condition of affairs during extirpation, and because the vessels of the false pedicle must favor the growth of the tumor and demand consideration in the operation.

A very disagreeable complication is the adhesion of other structures to the pedicle. This occurs most frequently in broad pedicles. The adherent portions are usually loops of the small intestines. In some cases it is not necessary to separate them, if the division of the pedicle can be performed with certainty at some distance from the adhesions.

The pedicle may be absent, but in various ways and with an extremely varying significance. In small tumors the connection between the ovary and broad ligament may remain entirely unchanged. This will hardly ever be found in a tumor which furnishes an indication for extirpation, but it is sometimes found, during ovariectomy, when examining the second ovary, which is in the initial stage of degeneration.

The pedicle may also be absent if it has been entirely twisted off during torsion. The tumor is then nourished by adhesions to other organs. The great omentum assumes the rôle of a new pedicle with special frequency. In rare cases the shrunken ovary is found in the abdominal cavity without any connection with other parts. Cases have been described by Loebker,¹ Spencer Wells,² and Peaslee.³

The third form of absence of the pedicle is co-ordinate with interligamentary development of the tumor. The anatomical relations of this mode of development were admirably described by Kalténbach. The enlargement of the ovary in the folds of the broad ligament may take place in varying degrees. There may be merely a partial unfolding of the peritoneal reduplication, so that a portion of the ligament remains above the floor of the pelvis. Lateral portions of the ligament (towards the uterus and pelvic wall) may also remain unfolded. In other cases the tumor extends to the uterus with which it enters into intimate, broad-based connection. It may also extend to the pelvic wall, and here even the reduplication which passes to the iliac fossa (the infundibulo-pelvic ligament) may be unfolded by the entering tumor, and thus a broad connection made with the muscles of the iliac fossa. Nor does the subserous development always take place in the same direction. It occurs most frequently posteriorly, by elevation of the posterior fold of the broad ligament; it is much rarer anteriorly. In the former event the tumor grows backward below the floor of the pelvis, raises the bottom of

¹ Arch. f. Gyn., XIV., p. 448.

² Case 110 of his tables.

³ Amer. Journ. of Obst., 1878, p. 766.

Douglas's sac, where it often comes into broad and close contact with the rectum, or it extends into the retro-peritoneal space and between the folds of the mesocolon, so that the intestinal wall and tumor come into apposition without the intervention of the peritoneum. The peritoneal layer covering the posterior uterine wall may also be raised from the uterus by the entrance of the tumor and, after further advance in the same direction, a tumor starting from the right ovary and right broad ligament may pass between the folds of the left ligament.

I recently operated on one of these rare cases, and found the healthy left ovary situated upon the left broad ligament, which was distended almost to the size of a fist, and into which the tumor of the right ovary had grown.

In the much rarer cases in which the subserous development in the broad ligament takes place anteriorly, the peritoneum of the para-vesical



FIG. 30.—Sagittal Section.

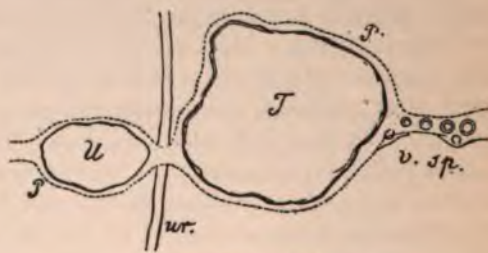


FIG. 31.—Horizontal Section.

INTRALIGAMENTARY TUMOR. U, Uterus; T, tumor; S, tube; P, peritoneum; Ur, ureter; v. sp, spermatic vessels.

fossa is raised, the tumor is closely connected with the wall of the bladder, the peritoneum is constantly pushed further upwards. Finally it may even be separated from the lowermost part of the abdominal walls, so that the tumor lies directly on the abdominal walls over Poupart's ligament, without any intervening peritoneal folds.

The subserous development may affect the entire tumor or only a larger or smaller section of its basal portion. Not so very rarely a part of the tumor, which had been situated beneath the peritoneum, subsequently becomes free, inasmuch as the thinned peritoneum is destroyed and the tumor is then bared over a greater or lesser area. This condition, which I have observed repeatedly, is not mentioned by other writers.

The relations of the tube to the tumor are also changed essentially in subserous development. While it is otherwise separated from the tumor by the mesosalpinx (with the exception of the fimbria and very rarely of a part of the ampulla), in marked subserous development this is no longer true, at least of the greater part of the tube. It is only the por-

tion which is immediately adjacent to the uterus that is not applied directly to the tumor. According as the subserous development takes place in this or that direction, a different part of the tube will first come in contact with the tumor. The part of the tube which is directly applied to the tumor may be considerably elongated (20 cm. or more), without undergoing any change in the thickness of its walls or its lumen.

Parovarian cysts are entirely covered by peritoneum, *i.e.*, subserous, but often they are not situated in the broad ligament proper. Indeed, they are not infrequently pedunculated, inasmuch as the traction of the growing tumor has formed a sort of pedicle out of the ligament, or it may, at least, be formed during the operation by the traction of the hand.

With rare exceptions the tube presents the relations described above. The fimbriated extremity is usually situated at the outer or posterior surface of the tumor.

The relations of the vessels of the tumor may be changed essentially by the unfolding of the broad ligament.

Instead of being situated in a band, as the spermatic vessels usually are at the lateral side of the base from tumor, the uterine vessels at the median side, they are now separated and displaced, and can no longer be tied collectively. The pampiniform plexus above the vaginal fornix also approaches the tumor, when the latter presents a marked development downwards.

When the tumor grows to the base of the broad ligament it is often in immediate contact with the ureter, with the aorta and ascending vena cava when it grows into the retro-peritoneal space, and with the large iliac vessels when it grows towards the iliac fossa. Figs. 30 and 31 illustrate the relations to the uterus, tube, vessels and ureter.

The uterus almost always experiences a diagnostically important displacement. At the beginning of unilateral subserous development it may be pushed against the opposite wall of the pelvis. Later it is almost always raised, and, if the subserous development takes place backwards in great part, it is somewhat anteverted.

The elevation is often so considerable that the portio vaginalis, whose length is reduced to a minimum, is reached with difficulty at the end of the markedly elongated vagina. At the same time the uterus is fixed; in bilateral, subserous tumors, it is absolutely fixed. The bladder is drawn upwards with the uterus and may extend far up towards the umbilicus.

It is of special practical importance that the tumor, which is closely applied to the organs and is no longer separated from them by a layer of peritoneum, may grow into their substance in such a way that they can no longer be separated, even with the aid of the knife. These destructive effects are exercised mainly, though not exclusively, by papillary cystomata and the affected organs are chiefly the uterus, bladder and rectum.

The conditions are further complicated, in some cases, by the often extensive adhesions of the outer surfaces of the distended broad ligaments. Loops of intestines and the posterior surface of the uterus are most frequently adherent. When one broad ligament is markedly distended, it may become adherent to the posterior surface of the other ligament.

It may be extremely difficult to note all these conditions during the operation, and in some cases it is impossible. Even the autopsy occasionally does not shed a perfectly clear light on the topographical relations.

The diagnosis of the subserous situation of a tumor is based chiefly on the recognition of its broad apposition to the entire lateral border of the uterus, or its juxtaposition to the pelvic wall, and the fact that the tumor covers the linea terminalis widely. But as these conditions are not necessarily present, and are still less always recognizable, the unusual elevation of the uterus with a small tumor, and the immobility of the uterus and tumor, are of special diagnostic importance. Finally, the marked descent of the tumor to the side of and behind the uterus, are extremely important, if these parts of the tumor are at the same time immovable while the immobility cannot be attributed to impaction in the pelvis. The relation of the tumors to the retro-peritoneal space and to the intestines has not been capable of diagnosis hitherto.

In the majority of cases, especially of bilateral, subserous tumors, the appearances are so characteristic that the diagnosis is possible without difficulty, and this possibility marks the greatest advance within the last decennium in the diagnosis of ovarian tumors.

Fortunately, treatment has made its greatest advances in the same field. In not a few cases, however, these tumors present enormous and sometimes insuperable difficulties. There is always a certain percentage of subserous tumors which cannot be extirpated completely or only with the greatest danger to the patient. This category always includes those cases in which the tumor has grown into the walls of other organs.

The importance of subserous development depends upon the great difficulty of extirpation and its relatively frequent occurrence. Among 250 successive ovariectomies, excluding parovarian cysts, there were forty-six¹ (18 per cent.) in which subserous development was observed. This proportion is undoubtedly above the average. By chance I had no fewer than fourteen subserous tumors among my last thirty-five ovariectomies.

Among the forty-six cases double ovariectomy was performed in eighteen cases; in twelve of these cases both ovaries were subserous, in six

¹ Two cases were counted twice because, after complete extirpation, they subsequently appeared for another operation. In one of the patients, moreover, the operation was declared impracticable, and the abdomen was again closed.

cases only one ovary. In many cases, as a matter of course, the subserous development was only partial, but in thirty the tumor was in great part or entirely subserous. This was particularly true of the bilateral tumors, most of which were papillary cystomata.

The intra-ligamentary development of parovarian cysts is rarely an unfavorable feature. Even in those cases which do not permit the formation of an artificial pedicle by traction, the enucleation is usually extremely easy, and it is only when the cyst grows between the layers of the meso-colon or into the retro-peritoneal space that the operation becomes somewhat more difficult.

The causes of the subserous development of ovarian tumors are entirely obscure. Freund and Schmidt assume a primary false position of the ovary as the cause, and think this is made probable by examinations of normal ovaries. This appears to me incredible with regard to the majority of cases.

The main argument against Freund's view is the fact that a special form of neoplasm, the papillary cystoma, is chiefly observed in subserous development, while this anomaly is very much rarer in proliferating cysts and has never been reported in solid tumors of the ovary.¹ Among my last seventy ovarian tumors (exclusive of parovarian cysts) there were twenty-one cases of subserous development, twelve of which were exquisitely papillary tumors.

For the present we can merely say that certain cystomata, especially the papillary ones, have a tendency to develop beneath the peritoneum rather than into the abdominal cavity. It is not improbable that, in these cases, the first development of the neoplasm takes place in the region of the hilus, so that its situation is extra-peritoneal from the first. Werth opposes the view that a part of the ovary grows into the ligament. But if the mesosalpinx is absent, as usually happens in subserous development, this explanation is permissible, and it practically amounts to the same thing, whether we say that the tumor grows into the ligament, or, with Werth, that the folds of the ligament are drawn upon the tumor.

TREATMENT OF THE PEDICLE.

The numerous methods of treatment belong to two groups, *viz.*, intra-peritoneal and extra-peritoneal treatment.

In intra-peritoneal treatment the pedicle is replaced, after it has been secured in some way against hemorrhage. This is done

1. By ligature *en masse*,
2. By isolated ligature of the vessels,

¹In one case, however, I saw partial subserous development of an ovarian fibro adenoma.

3. By cauterization of the pedicle,
4. By *écrasement*,
5. By torsion of the pedicle,
6. By acupressure.

The object of extra-peritoneal treatment is to keep the raw surface of the pedicle outside of the abdominal cavity. This is done

1. By fastening it with needles passed through the pedicle,
2. By stitching the pedicle,
3. By clamp treatment.

Apart from ligature *en masse*, cauterization of the pedicle is almost the only one of these methods which still meets with a certain degree of recognition.

1. Ligature *en masse* is the only method employed by the majority of operators.

When the pedicle is now replaced, the ligatures are cut short, because it is known that properly prepared aseptic material causes no reaction.

Thick pedicles are ligatured in two or three, exceptionally in four parts. In division into two parts, which usually suffices, the tissues are divided by the simple pressure of the finger in the middle, thinnest portion at a place which is free from vessels. The tube remains in one half, the ovarian ligament in the other half. If the division cannot be performed with the finger, an aneurism needle armed with a double thread may be employed.

All sorts of material (strips of leather, whip cord, fil de Florence) have been used for ligatures, but at the present time silk or catgut is employed by the majority of operators. Three years ago I recommended solid rubber bands. The results appear to be alike, when the material is completely aseptic. It is important to draw the ligatures as tightly as possible; in thick pedicles two knots are placed upon a surgical knot, and in order to prevent slipping, a thick mass of pedicle is left in front of the ligature. The objections to catgut, that it slips easily, that it is impossible to pull it tightly, and that the knots will loosen, are not justified if the ligature is properly made, *i.e.*, with solid, thick, double threads; if it is drawn firmly, and under vibrating movements of the hand is knotted three times, the ends in front of the last knot are left long, and a broad mass of tissue allowed to remain.

In order to be sure of complete asepsis, we should prepare the material ourselves; the raw catgut is placed for twenty-four hours in a $\frac{1}{10}$ per cent. solution of corrosive sublimate, and then kept in pure alcohol. This catgut is very durable, and when doubled, resists the strongest traction which may be necessary.

Silk possesses the advantage of being conveniently handled, and as it can be made absolutely aseptic, if prepared according to Czerny's recom-

mentation and kept in corrosive sublimate ($\frac{1}{10}$ to $\frac{2}{10}$ per cent.), it is employed by the majority of operators.

The degree of constriction effected by wire cannot be properly estimated, whether it is knotted or twisted. It is also apt to cut the pedicle, and finally, the cut ends are not altogether innocuous to the intestines.

Ligatures of solid rubber, 4 mm. thick, are very serviceable, in order to avoid loss of time in division and in the application of three or four ligatures, especially when the pedicles are thick. I have used them in about 100 laparotomies, and found them very serviceable. In some cases I have applied two, three, even four ligatures, for one or two pedicles, and for broad omental adhesions. It is kept in a sublimate solution ($\frac{1}{10}$ to $\frac{2}{10}$ per cent.), and smeared with a thin emulsion of iodoform immediately before using. The rubber band is drawn as firmly as possible, then crossed, and again carried around the pedicle. Its fixation is effected by a double simple knot, and the ends then cut short, or the taut ligature is fixed by a clamp, and then by a silk ligature placed around the second crossing.

In very thick pedicles I apply a silk ligature after application of the rubber, and in the same groove. With the exception of very thick and short pedicles, such as solid tumors present with special frequency, this plan, which makes division of the pedicle superfluous, can always be employed with sufficient certainty against hemorrhage. Formerly I constricted thick pedicles by means of wire twisters, and applied the catgut ligature (either as total ligature or after division of the pedicle) in the groove formed by the wire. This method is also a sure safeguard against hemorrhage, but it is somewhat more tedious. Moreover, it perhaps favors the development of tetanus, which I observed twice among 150 cases treated in this way. These circumstances have led to the abandonment of the plan.

A few peculiarities in the application of ligatures may here be mentioned. In division of the pedicle Murray ties both halves with one ligature, which surrounds the pedicle in a figure of 8. The thread, passed through the middle, is passed around half the pedicle, then perforates in the first position, is drawn around the second half, and tied. It is doubtful whether this produces secure constriction of both halves. Lawson Tait carries one loop through the pedicle, bends it around one half of the pedicle, carries the free end of the thread through the loop, and ties both free ends together.

Kaltenbach never carries the ligature simply around the pedicle, but always perforates it to prevent slipping. But if the pedicle is sufficiently long to retain a good stump, there is no fear of slipping if the ligature is tied firmly.

Erichsen recommended the dissection of a strip of peritoneum from the pedicle, in order that the ligature may compress the pedicle more securely, an unnecessary method. When the stump is long enough Thornton stitches its cut surface to the vesico-uterine fossa, in order to prevent adhesion of intestines to the raw surface.

The following are the chief objections to ligature *en masse*, and replacing of the pedicle:

1. The ligature does not afford security against secondary hemorrhage.

This has been the main reason for the invention and spread of extra-peritoneal treatment. It cannot be denied that many patients formerly died of internal hemorrhage. But since we tie in divisions and more carefully, and use better material, cases of fatal hemorrhage from the pedicle have become rare.

2. The retained sutures cause irritation of the peritoneum.

3. The danger of gangrenous destruction of the pedicle and the absorption of ichor.

These points will be considered in a general review of the intra-peritoneal and extra-peritoneal methods.

4. The danger that, after the return of menstruation, blood may flow from the pedicle into the abdominal cavity, and give rise to the development of hæmatocele or peritonitis.

Spencer Wells first called attention to the possibility of this danger. This occurrence is probable in view of the fact that blood sometimes escapes from the pedicle after extra-peritoneal treatment. But from the experience gained from pedicles which have healed into the abdominal walls, this would only be true of trifling amounts of blood which escape from the remnants of the tube. There are hardly any reported cases of such intra-peritoneal hemorrhages, which have given rise to clinical symptoms.

Kroner's case, which was reported as retro-uterine hæmatocele after ovariectomy, does not really belong to this category. The case was one of subserous cystoma. The base of the cyst had been ligated in four parts. Ligatures of the tissues had been necessary around several bleeding places. Ten days after the operation a retro-uterine tumor, as large as a hen's egg, was discovered, punctured per rectum, and a moderate amount of blood evacuated. The canula was kept in position. Twenty days later the remnant of the cyst, with four ligatures, was discharged per rectum. As a matter of course, this hæmatocele is to be attributed to a simple secondary hemorrhage after the operation. If the tumor had not been punctured and the canula retained, the small amount of blood would probably have been absorbed.

I have already described (page 217) cauterization of the pedicle with the aid of Baker Brown's or some similar clamp, and have stated that the slow cauterization of the pedicle in front of the clamp is not unimportant in checking hemorrhage. The prolonged compression of the pedicle with a broad clamp is also to be taken into consideration. For these reasons the mode of cauterization is not unimportant; the galvanocautery, even if used slowly, does not possess the above-mentioned advantages.

The galvano-cautery was first employed by Spiegelberg, but he has not found many followers. Moreover, Spiegelberg did not simply replace the cauterized pedicle, but either ligatured it at the same time, or placed it loosely in a clamp and then treated it extra-peritoneally.

Clay's method of cauterization of adhesions with the clamp has been extensively employed by but few operators. Among Baker Brown's forty-six cases treated in this way forty-one recovered, but this includes cases in which the ligature was also employed. Still better results were obtained by Keith, who for many years has treated almost all cases by cauterization and reposition of the pedicle, with results which have not been excelled by any, perhaps not equalled. In 1876 Keith reported fifty cases treated in this way with four deaths. In 1883, he reported four deaths among fifty-five cases, belonging to a continuous series of sixty-nine ovariectomies. Very few other living surgeons have adopted this method.

The opposition of almost all operators to this mode of treatment of the pedicle depends mainly on the fear of imperfect security against hemorrhage, and this security will probably not be reached before the necessary skill has been attained. In order to avoid paying bitterly for experience, it is therefore wiser to employ ligature of the pedicle.

The most varied forms of the cautery iron are employed. The prismatic irons are less serviceable than smooth pointed ones. They should be brought to a red heat. Maslowsky, before removing the cautery clamp, grasps the pedicle with forceps, which simply holds it without compressing it, except at a few points. Wright devised a cautery clamp which, after cauterization, only frees the pedicle step by step, so that the seat of hemorrhage can be seen more readily. If the pedicle still bleeds, cauterization may again be employed unless we prefer to ligature the pedicle. The isolated ligature of single vessels in the cauterized surface is not practicable, and this surface should not even be touched again. Thick, muscular pedicles are best adapted for cauterization. Secondary hemorrhage is more apt to take place in thin pedicles, probably because they contain fewer, but larger vessels than thick pedicles.

In order to prevent the supposed injurious effect of the eschar in the peritoneal cavity, Maslowsky devised the following plan under the term sero-plastic method: The pedicle is placed in a clamp for preliminary compression; then a rounded flap of peritoneum is separated, above the clamp, from the surface of the tumor. The pedicle is then cut through, the individual bleeding vessels touched with a beak-shaped cautery iron, and the surface of the pedicle covered with the peritoneal flap, which is fastened further backwards with silver wire.

3. *Écrasement* of the pedicle was first recommended by J. L. Atlee, and subsequently performed by Washington Atlee, Pope and Storer. The latter advises decidedly against the use of the instrument, because too

much tissue is constricted, and more vessels are divided than necessary. The great majority of operators regard the plan as uncertain and irrational.

Various operators formerly adopted the plan of placing the pedicle in a wire *écraseur* and then restoring it to the abdominal cavity. The *écraseur*, which was fastened in the lower angle of the wound, is gradually twisted tightly, and removed after it has become entirely loose. Koeberlé employed this method considerably until within recent times.

4. Most similar to *écrasement* in its action is twisting of the pedicle. The pedicle is fixed and the cyst is then turned until the pedicle divides. This method is only applicable to pedicles which are not too thick, and are sufficiently long. McLeod effected the twisting with two pairs of forceps, which grasped the pedicle securely by means of screws. The tumor is removed before the application of the external forceps, and then the twisting is performed. This method has been entirely abandoned.

5. Acupressure of the pedicle has rarely been performed. Breisky recently employed this method in two cases, the pedicle being fastened into the lower angle of the wound by means of acupressure needles and a wire loop. The abdominal walls are perforated, to the side of the wound, with a long, straight needle, the needle then passed superficially through the divided pedicle, and again carried through the abdominal walls. It is removed in fifty to sixty hours. The disadvantages of this method are undoubtedly greater than its advantages, particularly the disadvantage of insufficient security against hemorrhage, both before and after the removal of the needle.

The amovable ligature or filopressure is allied to acupressure. Aveling employed it in 1865, but he also divided the pedicle with the wire *écraseur*. The method was subsequently recommended by Böcker. It does not permit complete closure of the abdominal wound during the first few days, and thus does not offer the main advantage of intra-peritoneal treatment, while it is not free from its disadvantages. It has, therefore, not been adopted.

6. Isolated ligature of the vessels of the pedicle as the sole protection against hemorrhage was first employed in 1851 by Langenbeck. Five vessels were tied, but the pedicle was stitched into the abdominal wound. It cannot be denied that the ligature of the individual vessels of the pedicle, without ligatures *en masse*, appears most rational to the surgical mind, but this plan does not seem to offer sufficient security. Miner employed it after the application of a double, temporary ligature *en masse*.

But the ligature of the larger visible vessels in the cut surface of the pedicle, combined with ligature *en masse*, is often employed. Hayes ligatures the individual vessels of the pedicle beneath the peritoneum, after placing the pedicle provisionally in a clamp. This plan cannot be adopted in short pedicles, inasmuch as it presupposes that the pedicle can be seen against the light. In the thicker portions of the pedicle,

moreover, it must be an easy matter to overlook the vessels. The plan has only been used to supplement treatment with the cautery clamp.

7. Heyfelder performed torsion of the vessel of the pedicle, but lost three of his patients from internal hemorrhage. In 1871 Beebe reported six cases treated in this way, in none of which did secondary hemorrhage occur. Five patients recovered, the sixth died at the end of five weeks. Beebe divides the pedicle in parts, and twists the arteries and veins as they become visible.

The oldest method of *extra-peritoneal treatment* of the pedicle, is that of Stilling. He fastened the pedicle to the abdominal wound, a considerable portion of the tumor being left attached, then treated the bleeding vessels by torsion, ligature or actual cautery, and having turned the portion of the tumor with the entire raw surface to the outside, stitched it into the abdominal wound.

In 1849 he was followed by E. Martin, with the modification that the peritoneum of the pedicle was cut through, and the ligatures passed through that part which was deprived of peritoneum. These ligatures served to fix the pedicle itself, and not the base of the tumor, in the abdominal wound. Langenbeck operated in a similar way. In one case the pedicle was too short to be brought into the lower angle of the wound. Langenbeck then threaded a needle with all the twenty ligatures of the pedicle and the adhesions, and passed it through the abdominal walls above Poupart's ligaments, thus bringing the ligatures outside. The patient died of hemorrhage from the pedicle.

On the whole, stitching of the pedicle to the wound was not employed often, because it was soon supplanted by clamp treatment. Langenbeck and Storer modified the former method by closing the abdominal wound above the raw surface of the pedicle (pocketing the pedicle). Stilling subsequently modified his own method by fixing the pedicle with a needle which was passed transversely through the pedicle and the abdominal walls.

Koeberlé adopted the same plan in long pedicles.

The clamp treatment devised by Hutchinson in 1858 rapidly secured numerous adherents, and, until eight or ten years ago, was the most frequently performed procedure.

I have already described the various forms of clamp and the mode of application, but have not discussed its disadvantages, which may be formulated as follows:

1. It exercises traction on the pedicle unless this is very long.
2. It fixes the uterus to the abdominal walls in a manner which may be injurious in subsequent pregnancies, and also in other respects.
3. In rare cases fistula of the pedicle is left over, and may bleed periodically in an annoying manner.
4. It is not at all applicable in short pedicles.

5. It creates a band behind the abdominal walls, which may lead to occlusion of the loops of intestines.

6. It does not entirely exclude the danger of slipping of the pedicle back into the abdominal cavity.

7. It favors the development of tetanus after the operation.

8. It favors the development of abdominal hernia.

9. It does not allow complete closure of the abdominal wound, and thus permits the possibility of subsequent infection of the peritoneum.

The disadvantages mentioned under 1 and 3, are not very important, yet Baum observed such severe, permanent irritation resulting from traction of the pedicle on the uterus, that he decided on a second laparotomy one year after the operation, exposed the firmly adherent pedicle, and ligated and replaced it. The patient, who had been emaciated to a skeleton, rapidly recovered perfect health.

The fourth disadvantage refers only to the small minority of cases; that mentioned under 6, is also so rare as to be hardly worthy of consideration. The occurrence of ileus and tetanus after clamp treatment is more important. Although tetanus after ovariectomy is a rare sequel, yet it hardly ever occurs except after the use of the clamp. In addition, we do not know how the tetanus is produced and how it is to be avoided. Finally, this is such a terrifying event that it is easily understood why an operator, who has seen this affection after ovariectomy, should employ some other method than treatment with the clamp. These remarks also hold good concerning ileus, except that in addition to the causes of ileus which obtain after clamp treatment, there are other causes which occur after every laparotomy.

The development of an abdominal hernia at the place in which the clamp is situated, is not unimportant. Although abdominal hernia is not dangerous, as a rule, yet it is often a very annoying disease.

The most important objection to the method is that mentioned under 9. We will discuss it in the next section.

Although treatment with the clamp has now been generally abandoned, nevertheless it is a notable fact that many of the most distinguished operators obtained the greater part of their successful results by its means.

CRITIQUE OF EXTRA-PERITONEAL AND INTRA-PERITONEAL TREATMENT OF THE PEDICLE.

Since we have passed the period during which numerous patients died of hemorrhage from the pedicle, the most certain avoidance of septic infection must occupy the front rank in the question of treatment of the pedicle. In comparison with this, all other dangers of the operation are comparatively rare or slight.

The danger of septicæmia, starting from the pedicle, was formerly avoided by bringing the raw surface of the pedicle outside and keeping it away from the peritoneal cavity. How much can be done in this way, if strict cleanliness is enforced in other directions, has been shown by the masters of ovariectomy.

But the danger of septicæmia may not start from the pedicle. The destruction of the pedicle may not furnish the infecting material, nor its raw surface the site of inoculation. Indeed, this has undoubtedly been true of the majority of fatal cases of septicæmia after the operation. The peritoneum, with its large extent of surface and great absorptive power, is much better adapted for infection, and the cyst contents and blood which enter it, when it has been infected, are as poisonous as the decomposing remains of the pedicle.

In order to exclude the danger of septicæmia, therefore, we must make both these sources innocuous, and prevent absorption by the pedicle, peritoneum, abdominal wound, and divided adhesions.

Experience has taught that the external fixation of the pedicle does not prevent septic infection in innumerable cases, because the contents of the abdominal cavity remain open to septic infection, partly during, partly after the operation.

A dread of replacing the pedicle and closing the abdomen was entertained, partly because it was believed that the ligatures would produce peritonitis or induce processes of decomposition, partly from the assumption that the ligatured pedicle would act in the abdominal cavity as it does outside, *i.e.*, decompose, or, at least, undergo dessication and fall off.

The first question is:

1. What becomes of the ligature material? This depends on circumstances. Carbolyzed catgut is finally absorbed in the peritoneal cavity as it is in other living tissues. But it seems to me very probable that the absorption occurs more slowly in the peritoneal cavity than in other tissues.

In eleven autopsies on cases of ovariectomy, in which the pedicle had been ligated with thick catgut, I found the ligature perfectly firm and unsoftened, although death had not occurred, in six cases, until the sixth to the thirteenth days.

Silk ligatures remain unchanged for quite a long time. White blood globules gradually pass between their fibres and separate them from one another. The ligature is thus loosened, but remains intact and is enclosed in newly formed connective tissue. Rosenberg's experiments confirm these results. At the end of a few days, silk ligatures, like other foreign bodies, are surrounded, as the result of reaction on the part of the peritoneum, by a connective-tissue capsule, from which the migration of leucocytes takes place. The site at which the foreign body adheres is very important as regards the rapidity with which this process develops.

The greater omentum with its numerous vessels especially facilitates the attempted reaction.

One year after a double ovariectomy, Bantock found under (*sic!*) the peritoneum a little nodule which contained the knot of a silk ligature, while the loop and ends of the knot had disappeared. Two years after an ovariectomy, Hildebrandt did not find a trace of the silk ligature. In one case Lister found the knot eroded and surrounded by a layer of fluid, which contained detritus of silk. Salin found the silk threads quite unchanged two years after the operation; one thread was encapsulated. Garrigues found the silk ligatures unencapsulated at the end of two years.

According to Hollwachs, leucocytes also emigrate into elastic ligatures, and the surrounding tissues take up particles of their substance. A total destruction of elastic ligatures probably does not take place, but if they are perfectly aseptic, they become rapidly encapsulated. I have also had two opportunities of observing this encapsulation in the living subject, at the end of one and one and three-quarter years. The capsule was not of uniform thickness, and permitted the ligature, in part, to shine through distinctly.

2. What becomes of the ligated portion of the pedicle? This point has also been cleared up by the experiments of Spiegelberg and Waldeyer. They applied ligatures to the horns of the uterus in dogs, rabbits and cats, and it was found that after a certain lapse of time (days to weeks) the ligated portion had never become gangrenous. This has been corroborated by numerous autopsies after ovariectomy. Spiegelberg observed in two patients, who died three days after ovariectomy, that there was not a trace of gangrene in the stump of the pedicle. I have had the opportunity to observe eleven cases in which the pedicle had been ligatured with catgut, and only in one case was gangrene present. Peaslee was the first to arrive at the conclusion, from observations on the living subject, that the ligated pedicle does not undergo gangrene.

The ligated pedicle, which is left within the abdominal cavity, thus presents other conditions, as a rule, than one which is stitched to the abdominal wound and is left in contact with the air. The latter undergoes gangrene in almost every case, and the ligated portion is exfoliated. This difference depends on two factors. The properly ligated pedicle is no longer nourished from its central portion, and for this reason must undergo necrosis, unless nutritive material is supplied from another quarter. Minimum nutrition and protection against complete destruction in the abdominal cavity may perhaps be brought about for a short time by absorption of substances from the fluid contents of the peritoneal cavity. This assumption, however improbable *à priori*, cannot be absolutely discarded in view of our present experience. We know that transplanted pieces of the integument retain their vitality, although they are not

nourished for a short time by the circulation. Moreover, floating cartilages also appear to be capable of growth.

The conditions surrounding the ligated portion change in a few days, perhaps even more rapidly. Young cells are deposited on the ligatures, and connective tissue forms, which soon fills the ligature groove. The ligated portion, especially its raw surface, not infrequently adheres to adjacent parts of the peritoneum. Spiegelberg and Waldeyer noticed this almost constantly in the excised horns of the uterus; folds of the mesometrium had adhered to the ligated portion. Spiegelberg also found, in a case of ovariectomy, that the raw surface of the pedicle was adherent to the peritoneum covering the psoas muscle. In one autopsy I found the raw surface of the pedicle intimately adherent to the peritoneum of the floor of the pelvis. Many similar observations have since been made, and the repeated experience of adhesion to the intestinal serous lining with subsequent constriction of the gut, induced Thornton to unite the raw surface of the stump with sutures to an innocuous place, the vesico-uterine fossa.

But another view is also possible, and perhaps even more probable; when the nutrition of the ligated portion has ceased completely for only a few hours, it becomes a dead substance, without necessarily undergoing putrid degeneration. This dead body, together with the ligature material, is enclosed by connective tissue, and gradually diminishes in size by absorption. The possibility of such absorption has been demonstrated by numerous experiments. Hegar saw pieces of muscle, Ziegler pieces of bone, Tillmans and Rosenberger pieces of viscera, disappear completely in a short time in the abdominal cavity of dogs. Rosenberger found that a rabbit's kidney disappeared in twenty-eight days, a piece of muscle of 4 cm. in nineteen days. The condition necessary to rapid absorption is rapid adhesion of the foreign body to the peritoneum. Leucocytes enter it from the capsule which forms around it in three to four days. The work of absorption is probably assumed by the giant cells, which are found between the foreign body and the capsule. If the adhesion of the foreign body does not take place rapidly, there forms an, at first, very loose connection, by means of which the foreign body is, as it were, kept alive, inasmuch as it is gradually converted into connective tissue by wandering cells, and slowly grows smaller. Thus, Rosenberger saw a piece of muscle 4 cm. in size shrink to the size of a lentil in 103 days. In some cases, even under proper disinfection, pus forms within the foreign tissue, perhaps, as Rosenberger believes, from imperfect nutrition of the centre.

We now know that the ligated portion of the pedicle has the same fate, that it shrivels more or less rapidly, and often disappears completely. One year after ovariectomy, Bantock found the remains of the pedicle as a little nodule as large as a hemp seed, and containing the ligature. This

nodule was, probably, merely the new formed connective tissue around the pedicle, and under whose pressure and absorbent activity the ligated portion disappeared. Seven years after ovariectomy, Hime did not find even a trace of the pedicle or of the thick ligature which had been employed. In a parovariectomy I applied a catgut ligature around the ovary, which had been stretched to a length of 6 cm., and removed half of the ovary. When I performed a second laparotomy in the same patient six years later, the retained half of the ovary and the stump of the pedicle were found as a firm, white nodule as large as the head of a pin.

At all events, there is no doubt that a pedicle, ligatured with any of the usual materials, will not undergo gangrenous decomposition, when replaced, if putrid infection is prevented.

3. How do the replaced pedicle and the ligatures act upon the peritoneum? The ordinary effect is the above-described rapid formation of a connective-tissue capsule around the foreign body, without any further signs of local or general reaction. In exceptional cases there is suppuration around the stump or ligatures, and occasionally exfoliation of the ligature material or even of gangrenous shreds of tissue.

Hegar called attention long since to the often unnoticed evacuation of the ligatures through the bowels or other channels.

At the present time imperfect disinfection of the ligature material or stump of the pedicle is regarded as the most important cause of these abscesses, and for this reason they were formerly observed more frequently. But even with the most complete disinfection, the formation of an abscess around the pedicle or ligatures is possible, if the parts in question are in contact with the intestinal canal, and decomposition-producers pass from the latter into the foreign bodies.

When the abdominal cavity is not closed completely, but is drained externally or through the vagina, the formation of pus on the peritoneum is almost unavoidable, and is especially apt to occur at the ligature material or the constricted portions of ligated tissues. In such cases larger shreds of tissue are often exfoliated.

The case published by Hueffell showed that the abscesses sometimes form long after the operation. In an ovariectomy performed by Hegar, the pedicle had been replaced in the abdomen. Circumscribed peritonitis with exudation developed, but the patient recovered. Two and a half years later—parturition had occurred during the interval—an abscess formed, corresponding to the region of the left extirpated ovary. It

ened above the symphysis and discharged stinking pus, but no ligatures.

Two months after a parovariectomy, one of my patients suffered, during pregnancy, from the formation of an abscess which resulted in abortion. I have not observed any later abscess formation, and so far as I know Hueffell's case is unique.

Hence, it may be said that the production of suppuration in the liga-

ture material in a recognizable manner, but particularly the perforation of an abscess with or without discharge of the ligatures, is a rare event. Slight deposits of pus around the stump of the pedicle perhaps form more frequently, and are absorbed without giving rise to symptoms.

It must be especially emphasized that recognizable abscesses are extremely rare, when infectious substances are kept away from the field of operation. The fact that one observer notices them more frequently than another, may be due, as Hegar says, to the imperfect observation of the latter. This is true. But it may also result from the imperfect disinfection technique of the former.

It is difficult to decide whether the choice of the ligature material, assuming its complete asepsis, exerts any influence on the development of these abscesses. Perhaps there are slight differences, and it is probable that catgut, which is rapidly absorbed, is the least irritant. It might be supposed that the thick elastic ligatures, which are not absorbed, would exercise an irritant effect, but this is not borne out by experience. Among at least 120 ligatures which were placed in the abdomen in 90 to 100 laparotomies, there were not more than two cases of abscess, and these occurred in the early period of their employment. Löwenhardt's experiments and the observations made by me in a second laparotomy on the same patient, show the ease with which these sutures heal within the capsule.

Finally, the replaced pedicle may exercise a septic infectious action. The raw surface of the pedicle may receive the putrid poison, and give rise to septic peritonitis and ichorous destruction of the pedicle. Until not very long ago, this process undoubtedly occurred very often, and thus added greatly to the invention and spread of extra-peritoneal treatment.

On account of the nature of the septic poison, such cases generally run a rapidly fatal course. But if encapsulation soon occurs and absorption from the pedicle, leading to septicæmia, does not take place, a favorable termination is also conceivable.

The following case, referred to on page 227, is instructive in this respect: the greatest difficulties were encountered during the operation, which was performed without spray, on account of the broad adhesion of the left-sided tumor to the mesentery. But the tumor was extirpated completely, and drainage effected through the vagina. Peritonitis developed a few days after the operation, and a painful tumor formed on the left side of the pelvis; on the sixth day this was as large as a fist and felt distinctly from the outside. At the same time marked œdema of the left side of the vulva developed acutely. On the eighth day, during a passage from the bowels, the patient had an attack of vertigo, oppression, coldness, of the limbs and face, syncope, small and very frequent pulse, embolism of the pulmonary artery. On the twelfth day another attack occurred and terminated fatally.

The autopsy showed embolism of the right and left pulmonary arteries. In the pelvis, to the left of the uterus, was found an ichorous focus, which contained

the remnant of the tube and numerous catgut ligatures. This was completely encapsulated by adhesion of the omentum, sigmoid flexure and a few loops of the small intestines to the abdominal walls and uterus.

Had it not been for the occurrence of pulmonary embolism, which was associated with thrombosis of the pelvic veins, the ichorous focus would probably have perforated into the intestine and the patient's life been spared. The danger of grave septic infection had disappeared on the twelfth day.

4. What influence is exerted by the eschar, produced by canterization of the pedicle? This question has been decided favorably by experiment as well as by experience. The eschar is very thin and is exfoliated in a few days, without producing reactive inflammation. Waldeyer and Spiegelberg found the surface of the pedicle free from eschar at the end of six days; in three weeks it was smoothly coated. As a rule adhesions of the cauterized surface to the mesometria appear to form in animals. The adjacent tissues show imbibition of blood, thrombosis of the vessels and a certain degree of softening. Particles of carbon are found in the stump for a long time. Kaltenbach found the cauterized surface of a firm parietal adhesion perfectly smooth in a patient who died eight days after the operation; there was no trace of peritonitis. In one of Krassowsky's patients Heppner found particles of carbon, at the end of two years, scattered upon the organs adjacent to the pedicle; the latter had not become encysted.

The numerous favorable results obtained by Baker Brown and Keith with the cautery clamp, prove, more than experiments on animals, how innocuous the cautery eschar is to surrounding soft parts and to the organism. It produces neither peritonitis nor septic infection by absorption of the dead tissue. The latter is exfoliated, and unless carbonized is absorbed. It may even be claimed that the eschar affords a certain degree of protection against septic infection of the pedicle. Septic matters, which are situated there, are destroyed by the actual cautery, and rendered innocuous. The favorable tendency to heal, which is exhibited by wounds after galvano-caustic operations, is undoubtedly due in part or perhaps essentially to this very fact. Before the eschar has been exfoliated, granulations have formed under it, and absorption no longer occurs.

As a matter of course, this alone does not exclude the danger of septicæmia. But the wound of the pedicle has undoubtedly been the chief site of inoculation of the putrid poison hitherto, and unless general antiseptic measures are adopted during the operation, it is well to follow Keith's plan, and at least prevent infection of the pedicle by means of the actual cautery. Even ligature of the pedicle does not exclude the application of the actual cautery to the raw surface.

If we now review intra-peritoneal treatment of the pedicle, there can be no doubt that the formerly dreaded disadvantages, *viz.*, the production

of a septic focus in the peritoneal cavity, and the irritation of parts around the pedicle, will not obtain if external infection has been excluded, and it is then immaterial whether the pedicle has been cauterized or ligated. But starting with the conviction that infection can be excluded with approximate certainty by rigorous antisepsis, we must also believe that the replacement of the pedicle within the abdomen is the most rational and best method of treatment.

When the ligatures are properly applied, the disadvantages of intra-peritoneal treatment are reduced essentially to the dangers of subsequent hæmatocele and abscess. These dangers hardly ever threaten life, and are overbalanced by the disadvantages of the clamp, *viz.*, the danger of tetanus and the impossibility of complete closure of the abdominal wound.

Of both methods ligature of the pedicle is the most certain, at least for the inexperienced operator, and for this reason, perhaps, it will long remain more in vogue, although cauterization, when skillfully performed, should perhaps be placed on the same plane or even preferred to it.

Whoever employs strict antisepsis, and at the same time retains the pedicle outside, is inconsistent, inasmuch as he proposes making septic infection impossible from the start, while leaving one passage open in the pedicle itself, and another one alongside of it, since the abdominal cavity cannot be closed completely. Even if antiseptic dressings are to be continued until the abdominal wound and pedicle have healed, this will not prevent secondary infection with the same absolute certainty as complete closure of the abdominal cavity.

The clamp belongs to the past, the replacement of the pedicle to the future.

CHAPTER XXXVI.

OPERATIVE TREATMENT IN SUBSEROUS DEVELOPMENT OF THE TUMORS.

IN no other respect has the technique of ovariectomy been so perfected in a few years as with regard to the extirpation of subsEROUS tumors. In 1869 Miner of Buffalo recommended the essential features of the present method.

Enucleation of the tumor is the operation now chiefly in vogue. This is effected most readily in parovarian cysts, when they have developed in their peritoneal envelope towards the abdominal cavity, and not into the mesentery or retro-peritoneally. In non-pedunculated parovarian cysts the peritoneum is incised at the top of the tumor, the tips of the fingers pushed beneath the peritoneum, that portion of the surface of the tumor which is first exposed is seized with forceps, and then, while drawing constantly on the wall of the tumor, we pass more deeply between the latter and the peritoneal envelope.¹

The connection of the surface of the tumor with the peritoneum is usually so loose, that even a large tumor may be enucleated in a few minutes. As a rule, the hemorrhage is slight and requires no treatment. After enucleation the cyst is perfectly loose, as it possesses no pedicle.

These are the simplest cases. But those parovarian cysts which pass beneath Douglas's sac or into the prævertebral space, but especially those which extend into the mesentery, give rise to much more difficulty, and not infrequently induce considerable surface hemorrhages upon the surfaces of the mesentery. The enucleation of ovarian tumors, especially papillary cystomata, is still more difficult. The greater difficulties depend in part on the firm adhesion of the peritoneum to the surface of the tumor, in part on the more complicated structure of the tumors, which makes it more difficult to recognize the outer surface by the feel alone; upon the much greater vascularity of the tumors and their surface, and, finally, upon the fact that the subsEROUS development of the tumor very often is not confined to the broad ligament, but extends beneath the peri-

¹ In the first edition of the work I recommended enucleation, not from the peritoneum, but between both layers of the outer wall. I have entirely abandoned this view.

toneum of the floor of the pelvis to the retro-peritoneal space and into the mesentery of the colon.

The method of operation depends upon the complete or incomplete subserous development of the tumor, and its greater or smaller size. Large tumors must be diminished by evacuation of the main cysts, in order that we may reach their base. If the greater part of the tumor is intra-peritoneal, this portion, after it has been diminished in size and its adhesions divided, is brought in front of the abdominal wound, and the enucleation of the subserous part then performed. For the latter purpose the peritoneum at the base of the tumor is circumcised, and enucleation then performed with the tips of the fingers in the manner described above. If the entire large tumor is covered with peritoneum, the enucleation is begun as low as possible, in a place towards which a path has been made by previous diminution of the size of the tumor. In tumors which do not project notably above the pelvis, and especially if the peritoneal covering passes laterally into that of the iliac fossa without any distinct boundary, the peritoneum is incised on the upper surface and the entire tumor then enucleated.

The following remarks may be added concerning the technical difficulties: the firm adhesion of the tumor to the peritoneum and the adjacent organs (uterus, bladder, rectum, colon, cæcum, vermiform appendix, ureter, etc.), with which it comes in direct contact, often requires a considerable increase of the force employed, and when the organs in question are thin-walled (intestine, bladder, ureter), increased care to avoid injury to these parts. In certain places the separation cannot be effected by the pressure of the tips of the fingers, and we must then resort to cutting instruments or effect the separation with the fingers within the tissue of the tumor. In both events larger or smaller portions of the tumor are left behind. This happens particularly at the base of the broad ligament or at the anterior wall of the rectum, where the dangerous character of the neighborhood imposes great caution. The retention of at least small particles is unavoidable in those not uncommon cases, in which papillomata perforate the wall of the cyst, and enter the walls of adjacent organs. The tumor is then nailed to these organs, as it were, and in order to avoid rupture of the latter, nothing remains but separation within the tumor itself. If larger particles of the tumor are left behind, they may be removed afterwards with the knife, while smaller visible particles are removed with the nails or sharp spoon. The least importance attaches to particles on the walls of the uterus, because superficial resection of the wall may be performed without hesitation or the actual cautery may be applied.

When enucleation has extended as far as the base of the broad ligament, careful attention must be paid to the ureter in order to avoid injuring it. It is recognized by its white color, often by abnormal width,

compression and stasis of urine, and by the approximately sagittal direction of its course. In some cases it is exposed for a distance of 10 cm. or more in separating the tumor from the floor of the pelvis.

As the enucleation advances to the linea terminalis or the prævertebral cellular tissue, we must remember the proximity of the large vessels. In separating the ligament anteriorly the position of the bladder is to be taken into consideration.

Another important duty of the operator in these enucleations is to control the hemorrhage. When the infundibulo-pelvic ligament is distinctly recognizable, and is not effaced by raising the peritoneum, it is advisable to ligature the spermatic vessels before beginning the enucleation. This is usually also possible during the subsequent course of the

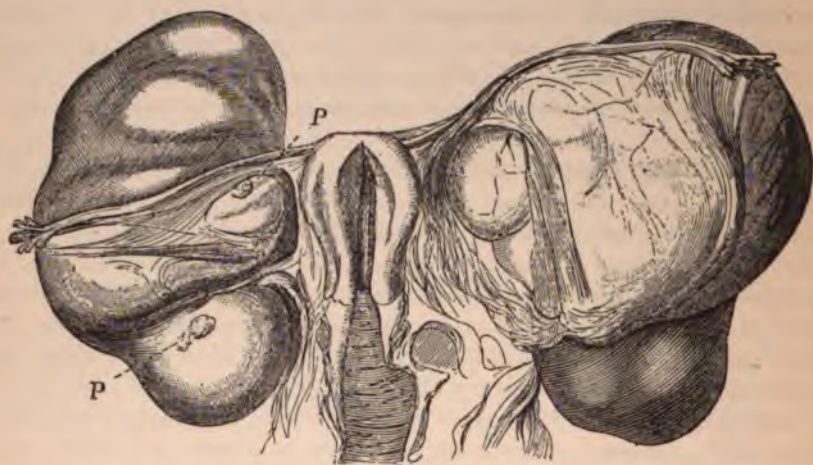


FIG. 32.—BILATERAL INTRA-LIGAMENTARY TUMOR. P, P, papillæ perforating the external wall.

enucleation. After partial evacuation of the broad ligament, it is also often possible and advisable to tie the structures which in other cases form the pedicle (tube and ovarian ligament). In general, the hemorrhage is to be checked by ligature of individual vessels, and inasmuch as we have to deal chiefly with surface hemorrhages, by ligatures of the tissues. When the latter are applied at the base of the ligament, care must be taken to avoid including the ureter. In many cases such ligatures cannot be employed, and we must then resort to temporary compression with cotton or sponges and to Pacquelin's thermo-cautery.

Ligatures at the lower part of the lateral border of the uterus are often very useful, but here the ureter lies near the median line and must be avoided. After the enucleation of the tumor, the thermo-cautery is excellently adapted to the posterior surface of the uterus, when, having

been entirely stripped of its peritoneum, it bleeds from a broad surface. Ligatures *en masse* are applied with difficulty to the wall of the uterus.

Despite the measures at our command, there are cases in which the hemorrhage is controlled with difficulty, and it has often been thought necessary in such cases to apply artery forceps, and leave them *in situ*, or to constrict the lowermost part of the tumor with wire twisters. This necessarily implies wide patency of the abdominal wound, and for this reason alone is to be avoided. In fact, I believe that we may always dispense with such measures. For a good many years and despite numerous cases of enucleation, I have not met with a single instance in which it was necessary to resort to such measures, and in which the abdominal cavity could not be completely closed.

While it is always desirable to check the hemorrhage absolutely, we must often forego this desideratum, and if there is only a moderate oozing from bleeding surfaces, it is best not to lose too much time in the attempt to secure absolute cessation of the hemorrhage. When the escape of blood is no longer considerable, the best measure at our command is to bring the bleeding surfaces in contact with one another, by closure of the abdominal cavity and a firm bandage.

Another important question is, what is to be done with the large connective-tissue cavity, and the peritoneal sac which has been freed from the tumor. Formerly the cavity was drained, either through the abdominal walls or vagina (a large trocar being passed through the floor of the cavity into the vagina). The edges of the peritoneal pocket were then stitched to the abdominal walls, in order to shut it off from the peritoneal cavity.

An excessive dread of the accumulation and decomposition of fluid in the extra-peritoneal cavity, was entertained. There is no doubt that the oozing blood and the remains of the cyst fluid are an extremely good soil for micro-organisms. But it is equally certain that, under strict antiseptis, septic infection hardly ever occurs. Parametritic processes are often observed in such cases; after more or less protracted fever they give rise to the formation of exudation, but rarely to abscesses. This disadvantage is slight compared with the results of drainage, *viz.*, secondary septic infection, very protracted suppuration and the formation of an abdominal fistula, which may last for years. Life is often threatened in the course of these processes, even after the lapse of months. The parametritis, on the other hand, is hardly ever dangerous, and generally runs a mild and rapid course.

Hence I strenuously advise to abstain from drainage in every case and to close the abdominal cavity. The question then arises, how is the empty peritoneal pocket to be treated? Shall it be closed and thus separated from the peritoneal cavity, or shall it be let alone? The stitching together of the peritoneal edges is possible in some cases, in others at least

a part of the exposed organs can be covered with peritoneum. In some cases neither plan is possible on account of the irregularity of the wound, or only after a great delay. Formerly I often covered the exposed organs with peritoneum, and closed the pocket with catgut sutures, but I have long been convinced that both plans were superfluous, that they did not guard against parametritis, and that they increased the danger of shock by prolonging the operation. I, therefore, leave the cellular tissue spaces open, but, before closing the abdominal cavity, wash them as clean as possible with damp sponges, which have been dipped in a solution of carbolic acid.

Incomplete extirpation of subserous tumors will be discussed in a subsequent section; we will now refer to certain complications during the operation.

First, the impossibility of separating the tumor, especially a bilateral, subserous tumor, from the uterus, and the consequent necessity of extirpating the uterus with the ovaries or rather of performing supra-vaginal amputation.

This dangerous procedure was formerly adopted more frequently, and Fig. 13 shows a preparation removed in this way. At the present time such an operation may almost always be avoided, although it has been performed recently by Reuss, Thomas-Goffe, Schenck, and with especial frequency by G. Braun. At all events, the uterus should not be extirpated without urgent necessity, as the dangers of the operation are increased not a little by this complication after the tedious, often very bloody removal of the ovarian tumors. But if the uterus is removed, the mucous membrane should be excised as extensively as possible from the lumen of the cervix, the canal then closed by special sutures, and the obliquely cut, raw surfaces of the cervical wound united by a second series of sutures.

The growth of the tumor into the mesentery is not infrequently a source of great difficulty. In such cases the hemorrhage during enucleation is always more marked and often considerable. We must resort to ligatures *en masse*, which constrict larger or smaller parts of the mesentery. When both layers of the unfolded mesentery are ligatured in large sections, the question arises whether the nutrition of the intestinal wall may be endangered. Small portions (an inch wide) of both layers may be ligatured without the slightest risk, and we have shown above that the intestine may lose a piece of mesentery 6 to 10 cm. wide, without necessarily undergoing gangrene.

In the rare cases in which the subserous tumor grows chiefly forwards, and pushes up the anterior fold of the broad ligament, it may finally be situated directly behind the abdominal walls, after pushing up their peritoneal lining. It may then happen that the operator, in cutting through the abdominal walls, does not enter the abdominal cavity, but passes at

once into the extra-peritoneal space in which the enucleation is to be performed. But the cases are extremely rare in which the operator, during the entire enucleation, would not be compelled to perforate the peritoneum in some part in order to operate securely. Thornton reported one case, however, in which the peritoneal cavity was not opened, but the anatomical conditions of the case are not unquestionable, inasmuch as a pedicle was finally found in which the tube was contained.

As a matter of course, subserous tumors have no pedicle, although the tube and adjacent parts are often gathered into a kind of pedicle after enucleation.

The literature of recent years shows that the majority of subserous tumors were papillary cystomata, that very many were bilateral, and that the results of extirpation were very unfavorable.

Netzel observed two subserous tumors among sixty-seven ovariectomies, Howitz five cases among eighty-eight operations. The following proportions obtained in my own practice:

Among 280 successive ovariectomies and parovariectomies, there were: thirty-one parovarian cysts with seven enucleations (23 per cent.), and 249 ovarian tumors with forty-five enucleations (18 per cent.). In addition there were three unfinished operations on subserous tumors. But I believe that the high percentage (18 per cent.) of subserous tumors is the result of chance, since among my last thirty-five ovarian tumors there were no less than fourteen of a subserous character.

The forty-five cases included eighteen double ovariectomies, in six of which one ovary, in twelve both ovaries were subserous. Recovery occurred in the seven cases of parovarian cyst. Among the forty-five cases of ovarian tumor thirty-nine recovered, including one patient who after a relapse, was operated on a second time; another patient died after the second operation.

The six deaths occurred: once on the first day from shock, once on the second day from collapse, once on the seventh day from inanition (old woman), once on the eighth day from pulmonary embolism, once on the thirteenth day from peritonitis, and once on the twenty-fifth day from exhaustion after protracted diarrhoea. In four cases the severity of the operation caused the death of the already weakened patient by exhaustion.

In judging of the results it must be mentioned that the cases date back to 1877, and that among the last forty operations on subserous tumors in thirty-eight patients (two double operations) there were only three deaths.

CHAPTER XXXVII.

PERITONEAL TOILETTE.—DRAINAGE.

CLEANSING of the peritoneal cavity, and even its examination concerning soiling, may be spared in rare cases. Cases occur in which the operation is absolutely cleanly and not even a loop of intestine or other viscus has been seen.

But in the great majority of operations it is at least advisable to examine the abdominal cavity, and to note whether blood clots or cyst contents are visible on the upper loops of intestines.

In the majority of cases toilette must be made more or less extensively. The clots or *débris* of tissue are removed with forceps or the hand, the cyst contents and other fluids with properly disinfected sponges. The question arises, to what extent is this to be done? When large amounts of bloody fluid are present, we must at least endeavor to remove it in great part. The largest amount of fluid collects in the pelvis and lumbar regions and occasionally in the vesico-uterine excavation, which may have been considerably distended by the tumor. Fluid in the latter position is easily overlooked. Formerly, and in great part to-day, extreme care was exercised to remove the slightest amount of blood and cyst contents, and this was undoubtedly very beneficial to the patient. If the contents of the abdominal cavity possessed any poisonous properties, it was important to remove as much as possible.

Wegner's experiments explain the great danger arising from substances deposited in the peritoneal cavity and the rapidity with which their deleterious effects occur.

The rapidity of absorption from the peritoneum is so enormous in rabbits and dogs, that if it were approximately equal in man, the abdominal cavity could absorb $2\frac{1}{2}$ to 6 litre fluid in an hour, and an amount equal to the weight of the body in twelve to thirty hours. Absorption from the peritoneal cavity is much more rapid than that from the intestines and subcutaneous cellular tissue, and is almost equal in rapidity to that of direct injection into the blood-vessels.

The abdominal pressure exerts a decided influence on absorption, and the latter is favored by vigorous intestinal peristalsis.

With regard to animal fluids which are introduced into the abdominal cavity, together with decomposition-producers (non-disinfected air),

Wegner believes that there is hardly any other part of the body in which the culture fluid suffers such rapid decomposition. But if the amount of fluid is small, absorption may occur before decomposition has taken place. In such cases there is no infection.

Pure blood in the peritoneal cavity does not undergo decomposition, even with non-disinfected air, while this takes place rapidly in the subcutaneous cellular tissue or other tissues of the body, if decomposition-producers from the air gain access to the blood. Wegner explains this striking difference by the assumption that the blood receives nourishment in the peritoneal cavity, whose endothelium assumes the rôle of the vessel endothelium. In the same way air which contains decomposition-producers is absorbed and made innocuous, as it is when injected into the circulating blood. But nothing is more capable of decomposition than the blood mixed with some other fluid, such as that of an ovarian cystoma. Blood is a most dangerous addition to all fluids which are already decomposing.

These results of Wegner's numerous experiments may also be regarded as applicable to the human peritoneal cavity.

In ovariectomy the abdominal cavity is very rarely soiled by blood alone. Cyst contents generally enter at the same time or even previously, in other cases ascitic fluid or a bloody transudation enters from the raw surfaces of torn adhesions. The fluid is thus extremely susceptible to decomposition. But the conditions of abdominal pressure are often notably changed for a time by the extirpation of a large tumor. It becomes reduced to zero or even becomes negative. Absorption is thus checked or abolished for the time, and this is increased by the paralysis of the cooled loops of intestines. Transudation from the peritoneum and the raw surfaces is increased under these conditions, and still more by the arterial and venous congestion of the intestines. In the same way secondary hemorrhage is favored from the still open vessels of the raw surfaces. Absorption only becomes more active with the restoration of positive pressure, whether spontaneously from the restored contraction of the abdominal walls, or artificially by the application of a compress and bandage. The smaller the amount of fluid present, the more quickly will it be absorbed, and the more possible it is that decomposition will not occur despite the presence of decomposition-producers.

As a matter of course, it was extremely important, before the introduction of antiseptics, to clean the abdominal cavity as thoroughly as possible. Hence, sponges provided with handles were passed into all the depths of the abdominal cavity, were pushed dozens of times between the loops of intestines and into the retro-uterine fossa, until they were removed as free from blood as possible, and as dry as when introduced. Irritation of the intestines or peritonitis is not produced by the sponges, but protracted manipulations of the character described may result in

torsion or volvulus of the intestines, and this has probably happened not infrequently as the result of peritoneal toilette.

After the division of numerous adhesions it is often impossible to secure perfect cleanliness, because sanguinolent fluid oozes constantly from the exposed wounds of the surfaces of the adhesions during the performance of toilette. After protracted operations and when the intestines are congested and paralyzed, even the intact peritoneum may rapidly transude, while in other cases it rapidly absorbs. In addition the general condition of the patient after protracted and difficult operations sometimes renders it desirable to close the abdominal cavity quickly.

The termination in such cases depends upon several factors,—the entrance of decomposition-producers into the abdominal cavity, the more or less complete absorption of the fluids before decomposition, the production of peritonitis (and thus of fresh deleterious substances capable of absorption) by the fluids which have undergone decomposition.

Before considering the more perfect means at our command of preventing sepsis in the abdominal cavity, we will mention various recommendations which have been made concerning the toilette. Nussbaum formerly recommended that, after the completion of the operation, the patient should be placed temporarily in abdominal or latero-abdominal decubitus, in order to free the abdominal cavity of its fluid contents. He even went so far as to perform the operation in a semi-abdominal position, in order to prevent the entrance of blood and cyst contents into the abdomen. Such procedures are, to say the least, unnecessary at the present time, and are probably not employed even by their inventor.

Hegar and Kaltenbach recommended that the fluid be pressed out, the hands being moved from the loins forward towards the wound. This may be very useful and shortens the toilette, but it will not remove the fluid from the deeper region of the pelvis, where the greater part accumulates.

Koeberlé holds the loops of intestines upwards with the hand, and then passes the sponges, without touching the intestines, along the concavity of the hand into Douglas's sac.

Many operators, especially among English surgeons, aspirate the accumulated fluids with syringes. Howitz abandoned this method after the intestine had, on two occasions, been aspirated so firmly into the lumen of the glass drainage tube, that it could only be released by breaking the tube. Hegar and Wiedow have recently employed hard rubber specula (abdominal specula), which are introduced deep into the abdominal cavity, and the fluids at their base soaked up with sponges or cotton. Peaslee employed wire specula in the same way for this purpose.

Hegar's recommendation to remove, by stroking, the air which enters the abdominal cavity during the operation, is undoubtedly a valuable one. In one case he was able to expel through the wound large quantities of

air, which had become entangled between the folds of the mesentery. But such an event will rarely happen, and only when the intestines have been manipulated a good deal during the operation. It is more often possible that after the removal of large tumors and in the ordinary position of the patient, air will accumulate in the upper part of the abdomen, between the upper end of the incision and the diaphragm. It is more difficult to express the air from this position because it may escape beneath the arches of the ribs and the concavity of the diaphragm. There is hardly any danger of inclosing air in the lower part of the abdomen, unless the abdominal walls are lifted up during closure of the wound with sutures, and air is thus aspirated.

There are rare cases in which, after extirpation of the tumor, all the loops of intestines remain immovable in the upper part of the abdomen, because they are held back by adhesions or a sort of second diaphragm, which has formed between them and the tumor. In such cases, the inclosure of a large amount of air in the pelvis and lower part of the abdominal cavity is unavoidable. Several cases have taught me that this is not necessarily attended by injurious effects. The empty space will soon be filled by intestines, by the gradual restoration of intra-abdominal pressure after the closure of the abdominal wound, and probably by the absorption of the air.

Scrupulously exact toilette, however important it formerly was, has become less and less an urgent necessity, the more thorough the antiseptic prophylaxis of laparotomy has become. No one will leave large amounts of fluid in the abdomen, whether they are derived from the tumor or from ascites, or contain considerable blood. As a matter of course, *débris* of tissue and large clots, which are visible without much exploration, will also be removed. But perfect cleansing of the entire abdominal cavity also has its dark sides, especially after very complicated and protracted operations, in which it seems to be most imperatively indicated. It undoubtedly increases the danger of shock, partly by prolonging the duration of the operation, but especially by the manipulations among the loops of intestines. Nor can it be denied that exploration among the intestines and their displacement may produce torsion of the axis of a loop of intestine. Finally, if there is any danger of septic infection, the extensive contact of the peritoneum with the fingers and sponges may produce the infection which we desire to avoid.

At the present time the extent to which the toilette is performed, varies with different operators. I am in favor of a short and restricted toilette, carried out in the manner described, and have followed this plan for the last eight years. In my opinion the chief weight must be attached to keeping away all infectious substances, *i.e.*, to primary disinfection during the operation. Numerous unclean operations have shown me that small clots or small amounts of fluid, which are left in the abdo-

men, do not cause any injury. The question is, to what extent does our prophylaxis afford us security in this respect. This subject will be discussed in the chapter on antisepsis.

As a matter of course, there are also cases in which the toilette must be performed in the strictest manner possible. These are the cases in which substances which are dangerous *per se* have entered the abdomen, viz., pus and particularly ichorous fluid or the contents of dermoid cysts; also the contents of the intestines and bladder (after injury of these organs).

Finally, the *débris* of papillary cystomata must be removed with the greatest possible thoroughness, since their retention involves a great danger of the formation of secondary tumors.

DRAINAGE OF THE ABDOMINAL CAVITY.

Drainage of the abdominal cavity is intimately connected with peritoneal toilette. Its purpose is the removal of the fluids which accumulate during or after the operation.

Drainage may be made towards the abdominal wound or vagina. In 1855 Peaslee employed abdominal drainage. Later Spencer Wells and Koeberlé employed primary drainage in certain cases, and occasionally secondary drainage (after the development of complications).

In 1872 Marion Sims proposed prophylactic drainage, in every case of ovariectomy during the operation, by perforating the recto-uterine fossa into the vagina, in order to secure the complete discharge of the fluids accumulated in the abdominal cavity. He gave the following reason for this suggestion. The majority of deaths after ovariectomy occur without diffuse peritonitis and without any serious local affection. They die from the absorption of putrid masses. A variable quantity of thin, often sanguinolent, foetid or acrid fluid is found in the abdominal cavity. This consists partly of blood and cyst contents which have entered during the operation, partly of fluid secreted, without inflammation, by the raw surfaces of the adhesions and by the peritoneum. In seven of his own fatal cases and in thirty-seven of Spencer Wells' thirty-nine fatal cases, Sims attributed the fatal result to septicæmia or pyæmia. He intended to remove the virulent fluid by draining the most dependent part of the abdomen, and thus destroy that cause of death which carries off the large majority of those who die after ovariectomy.

Sims's recommendation was received in various ways. Nussbaum adopted it enthusiastically. For a time I operated with primary vaginal drainage and had eighteen recoveries among twenty-nine cases (1875 and 1876). In 1877 I collated fifty-nine cases treated in this way with thirty-six recoveries.

But with the present antisepsis the condition of things has changed,

and no one believes that vaginal drainage should be employed in every case. We know that the drainage may cause secondary infection, and that this is much more apt to occur from the vaginal than from the abdominal walls.

The question now simply is, should primary drainage be employed at all, and if so, through the abdominal walls or the vagina? Drainage is now restricted to those cases in which the patient, from the beginning, seems to be unusually endangered, *i.e.*, in cases of very unclean operations in which thorough cleansing of the abdominal cavity cannot be attained. The majority of operators restrict the employment of drainage more and more.

Winckel (1881) restricts drainage to incomplete extirpations and accidental injuries of hollow viscera, Hegar (1884) to protracted operations with retention of contused tissues and imperfect checking of hemorrhage. So far as I know, Keith and Koeberlé drain in not a few cases, even at the present time.

On the other hand, drainage is employed very extensively by Bantock, Labbé, Billroth and Bardenheuer. The latter even recommends that drainage be employed after every ovariectomy. Among fifty-one successive ovariectomies by Billroth, drainage was omitted only once.

Bardenheuer's extreme views have been combated particularly by Miculicz, who opposed drainage with logical arguments.

With the exception of a short period in which twenty-nine cases were treated by drainage, I have never made extensive use of this procedure. Since July, 1882, I have not drained a single case, although there were many very unclean operations, but the condition of the patient imperatively demanded that the toilette be restricted to a minimum. The last two patients, who were treated with drainage, died of septicæmia. Since then septicæmia has not occurred among 124 ovariectomies. Single cases prove nothing with regard to drainage, but the individual operator may acquire the conviction, after a sufficiently large experience, that drainage is unnecessary or injurious even in unclean operations, and that it is possible to prevent infection during the operation with almost perfect certainty.

I have arrived at this standpoint with some other writers, and think it probable that this view will soon be generally entertained.

Primary drainage has also been employed, even in very recent times, in those cases of incomplete ovariectomy in which a part of the tumor is left on the floor of Douglas's sac. The remains of the cyst, together with the floor of the pelvis to which it was adherent, are perforated, and the drainage tube passed into the vagina. In my opinion the advantages of this plan are much more doubtful than the danger to which it gives rise.

It is generally believed that, in such cases, the remains of the cyst

should be stitched to the abdominal wound, and the drainage tube passed from the wound through the cyst into the vagina. This is regarded as devoid of danger to the peritoneum, because the drained space is excluded from the peritoneal cavity by the sutures applied to the abdominal walls. But the recent sutures, which also include a thin wrinkled cyst-wall, cannot possibly, before general adhesion has taken place, effect a certain protection against the entrance of septic matters.

I regard the stitching of the sac to the abdominal wound as a bad method, and prefer to replace the remains of the cyst without drainage.

Nor do I coincide with Labbé's opinion that drainage should be performed when ascites is present, and its rapid recurrence is feared. It is true that ascites is hardly ever evacuated completely in laparotomy, and that the patient is apt to suffer afterwards from slight fever, but the latter is always slight, and its rapid course is always aseptic and unattended with danger.

My theoretical objections to drainage are, in brief, as follows: an accumulation of fluid in Douglas's sac or a closed part of the peritoneal cavity may be removed with sponges as well as with the drainage tube. But if a large part of the abdominal cavity has been soiled in difficult operations drainage acts very uncertainly, even when used extensively, and at the same time considerably increases the danger of septic infection. The shape and other conditions of the abdominal cavity, where it remains open, do not permit the application of such a secure protective bandage as is possible in the majority of other wounds. It is especially difficult to guard securely the lower angle of the abdominal wound, which is really the most important. I agree, therefore, with Miculicz, who regards drainage as almost always unnecessary, and, in those cases in which it appears desirable, considers it unreliable and dangerous.

But when drainage is abandoned it is necessary that primary antisepsis should be as complete as possible. When this is still imperfect, it is not to be denied that drainage may be useful, as it often was in the pre-antiseptic period.

TECHNIQUE OF DRAINAGE.

Drainage in laparotomy has been performed with various sorts of drains. Marion Sims at first used silver canulæ for vaginal drainage. The majority of operators employ rubber or glass tubes. The latter are employed, for example, by Keith and Koeberlé. This material possesses the undoubted advantage of certain disinfection, and in addition the glass tube is not compressed like one made of rubber. Keith's tubes are open at the lower end and provided with a few lateral openings; Koeberlé's tubes are somewhat curved, without an opening at the end, but with numerous lateral openings.

I believe that drainage with carbolized gauze would act quite as

efficiently. At the same time the portion of the gauze which is situated in the abdominal wound, may be provided with iodoform and more effective protection against septic infection secured in this way than by the bandage, which is always uncertain in this region. I have drained in this way in pelvic abscesses and vaginal total extirpation of the uterus, and have become convinced of the efficiency of this method.

In drainage through the abdominal wound, as a rule, only a single drain is passed to the bottom of Douglas's sac; or perhaps a second one is passed into the vesico-uterine fossa or into an opened cellular tissue cavity or remains of the cyst. Billroth, however, drains much more extensively, not alone the pelvis, but as far as possible the entire abdominal cavity, and often introduces six to eight tubes. It is more than questionable, however, whether even such extensive drainage really drains all the recesses of the abdominal cavity, and whether fluids may not stagnate behind the mesentery or in other regions.



FIG. 33.—TROCAR FOR VAGINAL DRAINAGE. ($\frac{3}{4}$ natural size.)

Vaginal drainage has not always been performed in the same way: Spiegelberg and others recommended perforation of the floor of the pelvis from the abdominal cavity into the vagina. The canula of the trocar is applied to the deepest part of Douglas's sac. An assistant fixes its point in the vagina, then takes the trocar and perforates. I have usually perforated in the opposite direction, introducing the trocar into the vagina, and fixing, with the fingers of the left hand, the deepest point in the abdominal cavity. The trocar is then pressed slowly against the point marked internally, the inner hand covering Douglas's sac, and protecting the intestines from injury. As a matter of course, the vagina must first be thoroughly disinfected. A trocar of large calibre (25 cm. long with a lumen of fully 1 cm.), as shown in Fig. 33, may be used. The canula of the trocar may also be used for the introduction of the rubber drain, if this is preferred to other forms of drainage.

Some operators have had the misfortune to injure large vessels in perforating the floor of the pelvis. Billroth observed a very profuse hemorrhage. Winckel lost a patient from secondary hemorrhage from an injured branch of the hypogastric artery. In order to avoid this, Hegar

uses a fine trocar and then dilates the small opening with blunt instruments.

The rubber tubes generally employed for vaginal drainage are almost always carried out through the abdominal wound. In rarer cases Sims's plan has been adopted of placing canulæ merely in Douglas's sac and allowing them to project into the vagina. Antiseptic protection of the vaginal end of the tube can hardly be effected, and a protective dressing for the abdominal end is therefore useless.

When the drainage tube is situated in the abdominal cavity itself, it need only remain a few days, perhaps only twenty-four hours, since the fluids which remain after the operation will have drained away at the end of that time if at all. But peritonitic exudation cannot escape through the tube or only in very small part. Every drainage tube in the abdominal cavity will be closely surrounded by loops of intestines at once, and this in itself will, in part, render its action illusory. In the course of a few days or in a still shorter period the neighboring loops of intestines will adhere to one another, and thus entirely separate the abdominal cavity from the lumen of the tube. A few days later granulations form on the surface of the peritoneum, grow into the openings in the tube, and soon fasten it, like buttons, to the serous lining of the gut. As a matter of course, there is then no longer any question of drainage of the cavity, in which the tube has been placed. If the rubber tube is not removed until the end of a week, its withdrawal may be attended with some difficulty on account of the projecting granulations.

The conditions with regard to the duration of drainage are somewhat different when a retained remnant of the cyst, and not the peritoneal cavity, is to be drained, and its connection with the abdominal cavity has been abolished by stitching it to the abdominal walls. It is advisable to retain such tubes for a longer time, whether they have been passed through the abdominal wound or through the vagina, inasmuch as protracted suppuration always occurs in such cases. The sac should be kept open until it is sufficiently diminished in size, and the retention of pus is to be prevented under all circumstances.

CHAPTER XXXVIII.

CLOSURE OF THE ABDOMINAL WOUND AND DRESSING.

THE differences in the technique of closure of the abdominal wound are of slight practical importance. They pertain to the material and mode of suture, and to the inclusion or exclusion of the peritoneum in the sutures.

Almost every conceivable material has been employed for suture, from horse hair to telegraph wire, *i.e.*, copper wire covered with gutta percha. Most operators now use silk, others wire or catgut. Winckel and Howitz use silkworm gut (*fil de Florence*). Catgut should not be employed alone because it affords insufficient security against rupture of the wound during violent straining, coughing, etc.

The prevention of annoying suppuration from the suture tracks and secondary phlegmons of the abdominal walls depends chiefly on the complete disinfection of the suture tracks and not on the suture material *per se*. After the suture is completed, much also depends on the protection which the wound possesses against external influences.

The majority of operators use deep and superficial interrupted sutures. The twisted suture, as a principal suture, has been generally abandoned. The peg-stitch formerly employed by Koeberlé has also been used very little, although it possesses great advantages.

While the interrupted sutures are generally applied with curved needles in such a way that the first edge of the wound is perforated from without inwards, the other from within outwards, Spencer Wells attaches importance to the perforation of both edges from within outwards. He employs a thread armed at both ends with a straight needle, and Wormald's very serviceable needle-holder.

Since 1874 Koeberlé has abandoned his peg stitch for another form which he now employs exclusively. He pays no attention to the peritoneum; the structures of the *linea alba*, without the integument, are united by interrupted sutures, whose ends are drawn out externally. The integument is then coaptated by twisted sutures. The threads of the deep sutures escape spontaneously between the eighth and fifteenth days. Koeberlé abandoned the former peg stitch on account of the frequent development of abscesses of the abdominal walls, which he attri-

butes to the long suture tracks, but which were really the result of imperfect disinfection of the suture material.

Kovacs uses a three-fold suture. He coaptates the peritoneum with a catgut glover's stitch, then the abdominal walls with deep interrupted sutures, and finally, the integument with a catgut glover's stitch. If the abdominal walls are very thick, a deep glover's stitch is also introduced. In applying the deep interrupted suture, the edge of the wound deep down is included more widely than it is near the surface.

In extra-peritoneal treatment of the pedicle, the suture first applied over the pedicle must be deep and especially firm. Spencer Wells recommends that it be applied immediately above the pedicle, and that the lower angle of the wound should grasp the pedicle firmly, so that none of the dessicated or gangrenous part of the pedicle may enter the peritoneal cavity. Koeberlé attaches little importance to this, and leaves a small space between the pedicle and the lowest suture. He utilizes this space, when necessary, for the introduction of sponges into the abdominal cavity, in order to remove secretions which appear at a later period.

It is always advisable to follow Spencer Wells's recommendation that, before the introduction of the abdominal sutures, a sponge should be placed over the intestines, at a part corresponding to the abdominal wound, in order to absorb the blood which escapes from the suture canals.

The question whether the peritoneum should be included in the sutures has been answered in various ways. Wells believes that the only proper method is to include the peritoneum. He found, in experiments on animals, that the intestines and omentum adhered almost constantly, after laparotomy, to those parts of the abdominal walls which were not covered with peritoneum.

This method has since been adopted almost exclusively, and it has been recognized that there is no reason to apprehend any irritation from the sutures passed through the peritoneum. Wells mentions, as a special advantage of this method, the production of a firm cicatrix which does not tend to the formation of hernia. The peritoneum is to be perforated about 1 to 1.5 cm. from the edge of the wound and the broad stripes are made to unite. Wells maintains that in this way the sutures are situated entirely outside of the peritoneal cavity, but this seems to me to be impossible.

On the other hand, the following disadvantages have been ascribed to inclusion of the peritoneum; the possibility that blood from the suture canals, and also pus, which forms subsequently, may enter the abdominal cavity. I may add that the danger of septic infection from the suture material must also be greater when the peritoneum is included.

It seems to me that in using the interrupted suture, it is advisable to include the peritoneum, as in this way alone are we sure of its coaptation. This advantage counterbalances the slight disadvantages. But if the

peg stitch is used, it is sufficient to pass the needles in and out in the sub-peritoneal layer, immediately in front of the peritoneum, and at the same time we may be sure that the peritoneum will unite in two sufficiently broad strips, and will produce a firm and smooth cicatrix. In a dozen autopsies on cases treated in this way, I never found any tissue on the inner surface of the abdominal walls, which was not covered with peritoneum. The dread of adhesion of the intestines is, therefore, as unwarranted as that entertained by Peaslee, that the suppuration of such parts, which had been deprived of peritoneum, would give rise to danger. The peritoneum was always found in a linear cicatrix on the inner surface of the wound, and the closure was perfectly firm. In this form of suture the peritoneum almost necessarily adheres broadly.

The disadvantages which are said to arise when the peritoneum is not included, may hold good with regard to the interrupted suture, but surely not with regard to a properly applied peg-stitch. An essential advantage of the latter consists in the fact that, during vomiting, coughing, etc., the peg-stitch alone experiences tension, while the other sutures remain entirely free from tension.

The prevention of subsequent abdominal hernia does not depend on the certain and broad union of the peritoneum, inasmuch as this membrane can never resist strong intra-abdominal pressure for a long time. This requires particularly the muscles of the abdominal walls, and Peaslee's advice to include the recti muscles in the sutures, is, therefore, a very good one. This prevents abdominal hernia better than any other method. When the peg stitches are used, they are always inserted wide apart and include the muscles if this is at all possible. But if there is a broad diastasis of the recti, as happens so often in ovarian tumors, suture of the muscles is impossible, and no form of suture will prevent abdominal hernia with any degree of certainty. The occurrence of hernia is especially favored by treatment with the clamp or by the prolonged retention of a drainage tube in the abdominal cavity. The broad cicatricial mass developing in this locality, however firm it may originally appear to be, is unable to offer permanent resistance.

The peg stitch is introduced in the following way: a slightly curved needle, 12 to 14 cm. long, has upon its posterior extremity, instead of an eye, a short screw thread into which a tolerably thick silver wire is screwed. The needle is passed through the abdominal walls at a distance of 3 to 7 cm. from the edge of the wound, in such a way that it comes out either immediately in front of the peritoneum or includes a strip of the latter about 1 cm. in width. It is passed through the other side from within outwards in a corresponding way. Then the end of the wire, on the side of the operator, is carried through an ivory peg which is perforated in the middle, and is fastened by twisting it three times. One peg stitch is required for each 6 to 8 cm. of raw surface. After all

the peg stitches are applied, the sponge is removed and the wound closed. For this purpose the operator passes the left index finger into the abdominal cavity beneath the peg stitch, which is to be closed first, pushes the abdominal walls together from the sides with the right hand, and fixes the second peg, which the assistant places between the threads at the point of exit of the needle. The assistant then pulls upon the threads until the abdominal integument between the pegs rises in folds, and the index finger within feels the edges of the wound pressing against one another. At the same time the finger guards against the inclusion of a loop of intestine. When all the peg stitches are closed, the integument is united by a few superficial sutures. The needle is introduced farther from the edge of the wound when the abdominal walls are thick. If, at the same time, the extirpated tumor is small and superfluous abdominal walls are not present, it is best to discard the peg stitch and to apply only deep and superficial interrupted sutures.

If the peritoneum has been somewhat separated, through mistake, at one or the other edge of the wound, it is to be grasped by the peg stitch. The peritoneum often separates spontaneously for a short distance at the lower angle of the wound. It should then be fixed by a single interrupted suture before closing the peg stitch.

In conclusion it may be maintained, however, that the form of abdominal suture is comparatively unimportant. The chief point is its proper insertion, and in order to prevent the formerly so frequent and annoying abscesses in the abdominal walls, completely aseptic suture material is required.

The dressing of the abdominal wound may fulfill a double purpose, *viz.*, compression of the abdomen and protection of the freshly stitched wound against infectious matters. The former object is only sought when secondary capillary hemorrhages from adhesion surfaces are to be feared, or the absorption of retained fluids is to be favored, or finally, the accumulation of large amounts of blood in the abdomen is to be prevented. In the large majority of cases, however, compression of the abdomen is useless.

The protection of the wound against infectious matters is effected most certainly by a typical Lister dressing, or some other dressing of equally certain effect. In fact, however, the danger that substances, which lead to suppuration, may enter the suture canals or between the edges of the wound, is very slight, and may be excluded almost certainly by a simple covering of cotton, especially if the wound and sutures are lightly strewn with iodoform.

For the past year, therefore, I have confined myself to this form of dressing, and have observed only a minimum amount of suppuration from a few suture tracks. It is only when, for the reasons mentioned above, compression of the abdomen is desired, that this is carried out by means of bandages and underlying cotton.

CHAPTER XXXIX.

ANTISEPSIS.

IT is not the purpose of this treatise to discuss the theory of antiseptic treatment, to explain or demonstrate its advantages, or to compare the various antiseptic methods.

Carbolic acid is not always necessary for strict antiseptis. Hegar was the first to show, with regard to laparotomy, that admirable results may be attained without Listerism in the stricter sense. Experience has also shown that the individual procedures, in the typical Lister method, possess a very unequal importance; some are absolutely indispensable, others unimportant or even unnecessary.

The following remarks hold good in this respect with regard to laparotomies; the spray is not very important for the purpose of securing good results, least of all the spray which is directed upon the field of operation. The spray was not abandoned very quickly in laparotomy, after it had disappeared from surgical wards, for the reason that in the former operation, it could not be replaced by profuse irrigation of the raw surfaces with disinfectant fluids. For some time, however, at least in Germany, the majority of operators have abandoned its application to the field of operation, and only employ it before or during the operation, in order to disinfect the air. This is also unnecessary if a good operating room, which has not been entered by patients with infectious morbid products, is at our disposal.

Billroth has long replaced the carbolic acid by the salicylic acid spray. Since December, 1880, Keith has also abandoned the spray, after using it for a short time. Both operators dreaded carbolic acid poisoning of the patient. Despite the use of a powerful spray for years I have never observed such cases, but I have always placed a gutta-percha screen between the patient's head and the spray apparatus. I was unable, however, to protect myself and my direct assistants against the symptoms of poisoning, which often set in during protracted operations. For two years I used the spray only for the air of the room, and now employ it only before the operation.

Lister's protective bandage is still less important as regards the final result of the operation. It merely possesses a certain significance in preventing suppurative processes, which start from the suture canals in the

abdominal walls. Dusting with powdered iodoform or a simple dressing with cotton, secures almost exactly similar results, provided that the abdominal wound is completely closed.

Drainage has been already considered. Irrigation of the field of operation, during or after the laparotomy, with solutions of carbolic acid or other disinfectants, has been employed for a long time. It has been used very vigorously by Spiegelberg and Nussbaum, and Baumgartner allows as much as 10 litre of the salicylic acid solution to enter under strong pressure. I must earnestly protest against flooding the peritoneum with large amounts of fluid. If carbolic acid solutions are selected, there is always danger of poisoning, even if the fluid is evacuated as completely as possible. But all other fluids also involve, to a high degree, the danger of shock, especially after prolonged narcosis and difficult operations. I have so often observed symptoms of shock immediately after irrigation of a watery solution of thymol ($\frac{1}{10}$ per cent.) that the connection between the irrigation and the shock is undoubted. Some of these patients did not recover from the collapse, and I am decidedly of the opinion that I have repeatedly lost patients as the result of these irrigations. I may also remark that poisoning with thymol seems to me to have been probable in some other cases.

The most important antiseptic procedures are those which refer to the disinfection of the operating and assisting hands and the instrumentarium. Operators adopt various plans, and there is no doubt that good results have been obtained by various measures, such as carbolic acid, thymol, corrosive sublimate, iodoform, alcohol, and super-heated air. Everything depends upon the scrupulous manner in which the plan is carried out. And since the surgeon cannot carry out the preliminaries of the operation without assistants, the latter must also be thoroughly drilled. The less frequently the assistants are changed, and the more the operating room and all its appurtenances remain the same in the various operations, the greater will be the guarantee that antisepsis will be carried out strictly.

I will make the following brief statements concerning the mode of disinfection of hands and material, now adopted in our gynecological clinic: a $\frac{1}{10}$ per cent. solution of corrosive sublimate is used for disinfection of the hands before the operation, the hands being scoured with soap and brush in this solution for five minutes. During the operation the operator and assistant have standing behind them a vessel containing a $2\frac{1}{2}$ per cent. solution of carbolic acid, in which the hands are washed repeatedly during protracted operations. Before the first entrance into the abdominal cavity, the hands and forearms receive a thin coating of an emulsion of iodoform.

Before the sponges are used they are boiled in dilute hydrochloric acid, then kept in a solution of corrosive sublimate ($\frac{1}{10}$ per cent.), wrung

out before the operation, and repeatedly washed in $2\frac{1}{2}$ per cent. solution of carbolic acid in order to remove the corrosive sublimate. During the operation they are first cleaned in running water, then in a $2\frac{1}{2}$ per cent. solution of carbolic acid.

The silk is boiled in a 10 per cent. solution of carbolic acid, and kept in a $\frac{1}{10}$ per cent. solution of corrosive sublimate. Rubber ligatures are kept in a 2 per cent. solution of corrosive sublimate, and are not removed until used. Catgut is placed, as raw catgut, in $\frac{1}{10}$ per cent. solution of corrosive sublimate for twelve hours, and then kept in alcohol. Rubber and thick silk ligatures, for example, those intended for the pedicle, receive a thin coating of iodoform emulsion immediately before application.

All instruments are brushed with soap, before the operation, in a 5 per cent. solution of carbolic acid, and are kept in a similar solution during the operation.

The sponges and instruments are used only in laparotomies. The former consist of four series which are used alternately. The same series is often employed for six to ten laparotomies.

The greatest advances made in ovariectomy are due entirely to antiseptics. Spencer Wells, with his immense experience, could not obtain, among 800 ovariectomies, more than eighty successful results among 100 cases (usually only seventy-six or even less). As the result of the adoption of antiseptics, however, he had eighty nine recoveries in his tenth hundred. Similar or even more surprising differences occurred in the practice of other operators. Thornton states that antiseptics reduced the mortality of his laparotomies from 23.9 per cent. to 4 per cent. Among my forty operations without antiseptics, there were nineteen deaths (47.5 per cent.). With antiseptics there were fifteen deaths (seven from sepsis, one from chronic peritonitis) in the first hundred; eight deaths (four from sepsis, one from chronic peritonitis) in the second hundred; four deaths (none from sepsis or peritonitis) in the first ninety-eight of the third hundred.

After the universal experience in general surgery, it would not be thought possible that there are still surgeons, like Lawson Tait, who entirely deny the value of antiseptics. The results of Koeberlé and Keith are also adduced in opposition to the advantages of antiseptics. Koeberlé has never used carbolic acid, and Keith employed the spray only for a short time, and obtained better results without it. But Keith and Koeberlé were the first ones to employ antiseptic measures, and these the most important ones, *viz.*, disinfection of the material and instruments. For years Koeberlé has prepared the sponges with the aid of sulphates and alcohol. Keith has also employed similar measures. And if the sponges were merely cleaned in boiled water during the operation, this is an antiseptic measure which may suffice under certain conditions. But when Lawson Tait regards antiseptics as injurious, and has had a mortality

of 4 per cent. or even 3 per cent. in 100 laparotomies, he seems to identify the notion of antiseptics with that of the use of carbolic acid. Every one is probably convinced that Tait obtains such results only by means of antiseptic prophylaxis, whose fundamental condition is cleanliness. How Tait carries out this prophylaxis with regard to the hands, sponges and instruments, I do not know, but that he employs prophylaxis of some sort, is unquestionable.

In 1877 I pointed out that among Spencer Wells's 827 ovariectomies (without antiseptics) there were, in addition to various long series of recoveries (as many as twenty-one or even twenty-seven), also series of fatal cases.

In the 827 cases two successive deaths from septicæmia or peritonitis occurred ten times; in addition there were the following series of fatal cases:

Number.	Operations.	Deaths.
24-26	3	3 (1 septicæmia, 2 exhaustion.)
31-35	5	5 (3 septicæmia, 1 exhaustion, 1 tetanus.)
81-83	3	3 (3 septicæmia.)
159-162	4	4 (1 peritonitis, 1 exhaustion, 1 pyæmia, 1 embolism.)
194-197	4	4 (3 septicæmia, 1 pyæmia.)
287-293	7	7 (1 peritonitis, 6 exhaustion.)
296-298	3	3 (2 peritonitis, 1 embolism on 3d day.)
448-451	4	4 (2 septicæmia, 1 exhaustion, 1 hyperpyrexia.)
473-475	3	3 (3 peritonitis.)
515-529	15	9 (6 septicæmia and peritonitis, 1 exhaustion, 1 intestinal obstruction, 1 uræmia.)
552-555	4	4 (4 septicæmia and peritonitis.)
626-630	5	4 (4 septicæmia.)
637-645	9	6 (5 septicæmia, 1 embolism.)
779-783	5	4 (3 septicæmia, 1 exhaustion on 6th day.)

No one who is free from bias will believe that these successions of deaths are the result of chance. We must assume a connection between the cases in the individual groups. This connection is to be sought in the common source of infection, or in its conveyance from one case to another. In short the deaths, at least in great part, resulted from septic infection, which could probably have been prevented, in the majority of cases, by strict antiseptics. Spencer Wells himself will probably now admit that almost all of the cases of "exhaustion," which term is used so frequently in the first hundreds, but subsequently grows less frequent, are to be regarded as septicæmia.

I have reason to believe that this demonstration of the necessity of

antisepsis, deduced from Spencer Wells's own tables, was not one of the minor reasons which induced this surgeon to employ antisepsis.

In the first 113 cases upon which Wells operated antiseptically (after January 1st, 1878) there were no further series of fatal cases, *i.e.*, among two or three successive operations there were no longer two deaths which could have been connected with one another. Two patients alone died in succession, but death resulted from embolism. As was to be expected, antisepsis made the accumulation of fatal cases impossible, while in the first 800 cases it is very probable that eighty-three deaths were dependent on one another.

This result has appeared to me sufficiently interesting to be reported again, although it will not astonish any one who justly values the significance of antisepsis.

CHAPTER XL.

ACCIDENTS DURING THE OPERATION.

FATAL HEMORRHAGE DURING THE OPERATION.

IN former times cases of fatal hemorrhage before the operation was completed were often observed, but hardly any cases have been reported recently. It is only in the rarest cases that such an accident could happen, unless it was the manifest fault of the operator. Even when a large pelvic vessel is torn during the separation of firm adhesions in the pelvis, the operator will almost always be able to prevent fatal results. This may be more difficult in those cases in which the walls of the tumor are the source of hemorrhage, especially if they are very brittle. In a case of multilocular, extremely brittle tumor, a considerable hemorrhage occurred after the evacuation of several cysts. It was impossible to find the source of hemorrhage, since every manipulation, even the cleansing of bleeding cavities with sponges, caused rupture of fresh cysts, so that the entire field of operation was flooded constantly with a thin fluid, which gradually acquired a bloody color. I was only able to prevent immediate death by passing rapidly through the still present adhesions (without adopting the usual precautions) to the pedicle and ligaturing it. The patient recovered consciousness and the radial pulse returned, but death occurred on the second day, and undoubtedly resulted from the enormous loss of blood.

When the hemorrhage comes from the tumor and cannot be checked directly, the rapid ligation of the pedicle is always the only means of relieving the bleeding.

DeMeillon (Rev. N. Wacht 1886 p. 387) performed ovariectomy on a bleeder, without producing any notable hemorrhage.

It should not be thought that cerebral anæmia without hemorrhage may occur when a very large size is excised and the blood of the body is excessive. On removal of the tumor, flows into the abdominal cavity which are fatal have been met with. But this danger is only to be apprehended in tumors of enormous size, and those whose weight exceeds 1000 gms. (22 lbs.) and whose diameter is almost the size of the tumor by itself.

The hemorrhage is not a frequent occurrence, and is exceedingly rare in this

country. Among the last 280 ovariectomies there were eighteen tumors which weighed 15 kilo or more. Among the last half of these 280 operations there are only four of these large tumors, all of which weighed less than 20 kilo, while among the fourteen large tumors of the first half, four weighed 20 to 30 kilo, two weighed 30 kilo and one weighed 40 kilo. In five cases puncture was performed one or two days before the operation on account of the size of the tumor. In one case of bilateral tumors, whose combined weight was 30 kilo, preliminary puncture was omitted for other reasons. When both tumors (after considerable diminution) appeared almost simultaneously as a quite large mass through the very long incision, the patient, who was not narcotized very profoundly, suffered from syncope at once. Everything had been prepared for this emergency. The head was at once lowered, the limbs wrapped in cloths, and an assistant compressed the aorta directly in the abdominal cavity. This compression was continued about twenty-five minutes, the time required for treatment of the pedicle and toilette. The syncope disappeared and the patient recovered.

3. Injury of the intestines, bladder and other important organs. Injuries to the intestines have probably occurred much more often than they have been recognized. But it would be a mistake to believe that all intestinal fistulæ, occurring after ovariectomy, are the result of direct injuries. As we will see in the discussion of the sequelæ, some fistulæ develop very long after the operation.

In the majority of cases the intestinal injury has been rapidly followed by a fatal termination.

Apart from very intimate adhesions injuries to the intestines are especially apt to occur in subserous development of the tumors.

After injury to the intestines the most important measure in all cases is the proper suture of the gut. But if the gut is torn very severely, the injured loop should be resected. Protheroe Smith¹ stitched the gut into the abdominal wound, but this plan should only be adopted in cases of extreme necessity. This forms an artificial anus, which is to be closed at a later period.

Injuries to the bladder are as serious as those to the intestines, and are much more frequent. They occur particularly, as was previously stated in those cases in which the bladder extends high up in front of the tumor. This takes place especially in subserous tumors, in which the bladder, together with the uterus, may even reach to the level of the umbilicus. Enucleation of a tumor, which has grown up to the bladder, may also cause injury to the latter.

The injury occurs in various ways. In most cases the bladder was mistaken for a part of the cystic tumor, and was punctured or incised as

¹ *Lancet*, Mar. 4th, 1871.

such At other times it was injured before the tumor was visible, because it was mistaken for the abdominal walls. Julliard produced a rupture 12 cm. long as he was separating, without any great traction, the bladder, which was adherent to the tumor

Terillon collated twenty-five cases of injury to the bladder, fourteen of which terminated fatally.

Injury to the bladder requires sutures. Bantock does not include the mucous membrane. Eustache carries the sutures through the entire thickness of the walls. Julliard inverted the edges of the wound and applied a Lembert suture. The patient died seven months afterwards from cancer of the liver, and the suture of the bladder was found as a fine white line. When the peritoneal covering of the bladder is intact and firmly applied to its walls, Lembert's suture furnishes the best guarantee of success. In addition it is always advisable to introduce a catheter permanently for some time.

Gallard adopted an unusual procedure. He stitched the opening in the bladder to the abdominal walls and drained. A few weeks later he operated on the vesico-abdominal fistula. Such a plan may be justifiable under unusual conditions and when the lesion is extensive.

The favorable course of some cases of injury to the bladder, and the tendency to spontaneous recovery is a striking fact. In two operations in which adhesions of the bladder to the tumor had been divided, Billroth observed, four to five days afterwards, the escape of urine through the abdominal wound. Spontaneous recovery occurred within three weeks in both cases. Spencer Wells mentions a similar case. One of Eustache's patients recovered, although the urine flowed into the abdominal cavity for an hour during the operation. Hegar injured the bladder after enucleation of an intra-ligamentary tumor, as he was draining the cavity of the ligament into the vagina. The fistula closed very quickly.

W. Atlee and Spencer Wells report cases of injury to the urachus, which had remained open. In Atlee's case the resulting abdominal fistula closed rapidly. Spencer Wells included the urachus in one of the deep abdominal sutures, and no symptoms of the injury followed.

Injuries to the ureter may occur during the enucleation of subserous tumors. The ureter is either torn or it is included in a ligature, and perhaps cut through. Four cases of this kind have been reported, and all terminated in recovery.

The first case (Walther) occurred during extirpation of the uterus with both ovaries on account of disease of one ovary. The left ureter was injured and the urine was discharged through the abdominal wound along the pedicle. G. Simon cured this fistula by extirpation of the left kidney.

Nussbaum adopted a different plan. During the ovariectomy he had placed the pedicle in a wire *écraseur*, and was compelled to separate the

tumor, which was adherent to the uterus, from the latter, the peritoneal covering of the uterus being also separated. The *écraseur* was removed on the eleventh day with considerable force. It was soon found that a considerable amount of urine was discharged through the abdominal wound. Injections of a dark blue tincture of litmus into the bladder showed that this organ was uninjured, inasmuch as the secretion from the wound was not discolored. By passing a trocar through the urethra, Nussbaum first made a passage from the bladder into the urinary reservoir, in the region in which the ureter is normally inserted, and which was here obliterated. After the introduction of various canulæ he finally succeeded in keeping the new formed canal permanently open, and the abdominal fistula then closed.

Hegar and M. Müller operated in a similar way. The former first attempted to unite the cut ureter with the bladder, but this failed. The urine escaped through the vaginal drainage tube, and the abdominal walls. Subsequently the posterior wall of the bladder was perforated, and at the end of nine months, the abdominal fistula was narrowed to an opening as fine as a hair, and the urine passed through the bladder. Müller's case was one of incomplete extirpation of a subserous cystoma. A uretero-abdominal fistula formed in ten days. The wound was connected with the bladder, and the funnel of the wound covered by a plastic operation. Only a small fistula remained.

Among injuries to other organs it may be mentioned that in one case the entire kidney was unintentionally removed with the ovarian tumor. The mistake was discovered afterwards. According to Eustache, the case is mentioned by Spencer Wells in the *Med. Times*, 1870. Spencer Wells further reports¹ that, in a case of firm adhesion of a tumor to the liver, he removed several ounces of tissue from both lobes of the liver. The very violent hemorrhage was checked with chloride of iron, and the patient recovered.

4. Inability to complete the operation is one of the most disagreeable accidents in ovariectomy, but is becoming rarer from year to year, thanks to the advances in the diagnosis and technique.

Apart from the diagnostic errors, in which, instead of the supposed ovarian tumor, another form of tumor is found after the incision (cases which are commonly called "exploratory incisions"), the inability to complete an ovariectomy is the result of technically insurmountable difficulties in extirpation. In former times this was true of extensive and firm parietal adhesions, and this explains the former frequency of incomplete ovariectomies.

In 1850 Maisonneuve collated forty-eight completed operations, with fourteen which were uncompleted on account of adhesions, and seven in-

¹ Ovarian Tumors, p. 334.

cisions in false diagnosis; Kiwisch collected eighty-six completed operations with twenty-two incomplete ones and fourteen diagnostic errors. J. Clay's statistics in 1860 are more favorable: 395 completed operations with twenty-four incomplete ones, and 13 diagnostic errors. February 1st, 1877, Keith reported 229 completed ovariectomies with nine incomplete ones, and two exploratory incisions.

There are very few recent exact statements concerning the number of incomplete operations and exploratory incisions by individual operators.

Rokitansky (1884) states that since October, 1875, he performed forty-two complete ovariectomies, six parovariectomies and six incomplete ovariectomies. Howitz (1877) reports eighty-eight complete operations, four incomplete ones, and five exploratory incisions. Among seventy-four operations on the ovary and parovarium, performed by Karl v. Braun (1879 to 1884), there were three cases in which the tumor was not removed completely. Tauffer had four cases of this kind in fifty-nine operations. In addition to my 173 operations performed since January, 1881, there were four in which merely an incision was made into the abdominal walls or hardly any part of the tumor was removed; in addition, a larger or smaller portion of the tumor was left in the abdomen in eight cases. I must acknowledge that the number of cases in which the operation was not performed, or in which extirpation was incomplete, is unusually large. This is explained by the fact that the operations of the last four years include an enormous number of subserous tumors. Among the 173 operations and four simple incisions, there were no less than forty-five tumors which were partly or entirely subserous, *i.e.*, a fourth of all the tumors, and the majority of these were entirely subserous, and many of them bilateral. Two of the exploratory incisions were made in malignant tumors with metastases on the diaphragm or in the liver, the two others were made in cases of subserous tumors; all the incomplete extirpations were also made in cases of subserous tumors.

It is hardly necessary to say that at the present time most of these tumors could be extirpated completely, but at least three were of such a nature that complete extirpation was impossible. Among the eight cases of incomplete extirpation a second attempt at complete removal of the morbid growth was made in three cases, once without success, once with complete success, and once with the result that the removal was successful, but the patient died of inanition, without peritonitis.

Although we cannot determine with certainty in how many cases exploratory incisions and incomplete ovariectomies are now performed, it is unquestionable that both forms of unsuccessful operations have been reduced to a minimum when compared with former times. As a matter of course, however, the frequency of diagnostic errors and the inability to overcome technical difficulties will vary, now as formerly, according to the diagnostic experience and care and the technical skill of the operator.

But the statistics of incomplete operations can be collated with so much greater difficulty, because it is hard to say what shall be called a complete, what an incomplete operation.

At the present time it may be claimed that adhesions never make the operation impossible. There are only two difficulties which occasionally prove insuperable: 1. the extension of a malignant neoplasm of the ovary to adjacent tissues and organs; 2. subserous development of the tumor in its most aggravated form.

Individual isolated metastases of cancer to other organs are sometimes susceptible of extirpation. In a few cases I have successfully removed metastatic growths on the tube or uterus with the ovary. Billroth removed cancer nodules of the intestine and bladder by resection of both organs. But if many metastases are found, the recovery of the patient is impossible, and it is better to discontinue the operation. Even in the absence of metastases the ovarian tumor may be fixed in such a way by adhesions to the intestines, or by extension into the pelvic cellular tissue, that it cannot be extirpated. The intestine, in particular, is sometimes surrounded by cancerous tumors of the ovary, in such a way that their separation becomes impossible. Fortunately the diagnosis of advanced carcinoma may usually be made in such cases prior to the abdominal incision.

The other difficulty, *viz.*, subserous development of the tumor, has been overcome by enucleation in the large majority of cases. But when the connection of the tumor with adjacent organs, especially the rectum, is unusually firm, and when the papillary formations of the tumor have grown into the wall of the organs, complete extirpation will be impossible.

How rare this is in reality is shown by Schroeder's dictum, that nearly every ovarian tumor may be extirpated. Tumors which he could not remove two years ago, he now extirpated completely in a second laparotomy.

The fate of the patient has also been markedly bettered in another regard. Formerly when an unsuccessful attempt at operation was made, the life of the patient was always greatly endangered. Indeed, in cases of cancer the patient almost always died from the operation, even if a mere incision of the abdominal walls had been made. Of Spencer Wells's fifty-two patients in whom the operation was not completed, nineteen died; of Keith's ten cases six or seven died. At the present day a mere incision, even in carcinoma, is hardly attended with danger to life, while the large majority of patients recover from incomplete operations.

After an incomplete operation the majority of surgeons generally stitch the remains of the tumor with its walls to the wound in the abdominal walls, and drain externally, or, at the same time, through the vagina. Schroeder recommended this plan a few years ago, but hardly has an opportunity of resorting to it at the present time.

P. Müller also recommends this method as comparatively certain and

free from danger. In two years he treated six cases in this way; five recovered. Tauffer's four patients recovered; two of Braun's three patients died.

The results of this mode of treatment are not bad as regards the life of the patient. But the protracted suppuration, which usually lasts months, occasionally a year or more, is a very disagreeable addendum to this mode of treatment, and is long a source of danger to health or even life, whether from exhaustion of the vital energies or from thrombosis, which develops not infrequently in the vicinity of the purulent focus. The protracted suppuration and the gradual shrivelling of the stitched sac also produce changes in the abdominal cavity, which may become important at a later period, especially if a relapse occurs. Finally, according to Schroeder, this plan of treatment does not protect against relapses from the remnant of the tumor.

On the other hand I recommend, when a larger or smaller portion of the tumor must be left behind, that it be simply replaced in the abdominal cavity, and the latter completely closed. Even if the tumor, many of whose cysts have been opened, now communicates freely with the abdominal cavity, and the whole condition presents a filthy appearance, nevertheless there is no danger of sepsis or peritonitis if the operation is performed antiseptically. In addition, we possess the great advantage that much more of the tumor may be removed than when the sac is stitched to the abdominal walls. We leave as small a portion as possible, cleanse it as well as we can, and then close the abdomen.

As a rule, the patients recover from the operation without any reaction. Of the eight cases mentioned above, in which a part of the cyst was left behind, only one died, twenty-five days after the operation, from exhaustion due to continued diarrhoea. The case was one of bilateral, subserous cystoma, which was not papillary, but was unusual in so far as the cavities contained not a drop of fluid, but only tough, jelly-like masses, twenty-three pounds of which were evacuated. The loops of intestines were completely enclosed in these masses. The operation was very protracted, but was well borne by the patient. It is difficult to say whether the subsequent profuse diarrhoea was connected in any way with the abnormal contents of the abdominal cavity.

Of the four patients in whom extirpation was not performed at all, three recovered from the operation and remained alive at least for months. The fourth died, less as the result of the operation than of the disease itself. The case was one of ovarian angio-sarcoma with a metastasis in the liver. The extremely feeble patient, aged seventeen years, suffered from fever for weeks (nocturnal temperature of 39 to 40° or more). The high fever, whose origin could not be ascertained, gave rise to the hope that the tumor was perhaps undergoing gangrene or suppuration, and that the flickering life might thus still be saved. But the tumor pre-

sented extensive adhesions to the intestines, and was so extremely vascular that the patient would undoubtedly have bled to death during the operation. For this reason the operation was abandoned.

5. Complicating uterine myoma. In view of the frequency of uterine myoma, it is readily understood that they are not rarely found in ovariectomies. When the myoma is favorably situated on the cervix uteri, or the uterus can be palpated from without, the ovarian tumor being still small, we are not infrequently able to make a prior diagnosis of this complication. In one case I made the mistake of regarding as a myoma an apparently solid tumor in the pelvis, which could be clearly distinguished from the cystic ovarian tumor. The operation revealed a dermoid cyst of the other ovary incarcerated in the pelvis.

Small fibromata almost always constitute an insignificant complication. They are rarely adherent to the ovarian tumor, and in such cases it is best to let the fibroma alone.

But if the uterine tumor is large, adhesions are more apt to develop, and difficulties may then arise, because the myoma conceals the field of operation. Very few cases of this kind seem to have occurred hitherto.

Hofmokl found an elastic tumor on the right side of the abdomen, a solid tumor on the left side; between them was a depression of the abdominal walls, corresponding to the linea alba. The nature of the solid tumor remained undecided before the operation. It was then found to be a fibroma of the fundus uteri, as large as a child's head, with an insertion four inches wide. As the ovarian tumor, which extended behind the myoma into the left side, could only be reached after extirpation of the uterine tumor, the pedicle of the latter was first ligated and removed, and then the ovarian tumor was extirpated. The patient died thirty-two hours later from general peritonitis.

In Billroth's first thirteen ovariectomies, he was twice impeded by uterine myomata. In one case he ligated the pedicle of the ovarian tumor, which was adherent to the myoma, and removed it without difficulty. The patient recovered. In the other case a portion of the large tumor remained fixed in the pelvis, and it was found that the pedicle was firmly adherent to a uterine fibroma as large as a child's head. The separation, after ligature of the pedicle, gave rise to hemorrhage from the fibroma, necessitating ligatures of the latter. The patient died within thirty-six hours from foudroyant peritonitis.

The cases in which a small ovarian tumor is associated with a large uterine myoma, possess hardly more than a diagnostic significance. Spencer Wells found a slightly enlarged ovary with ascites and a large myoma; the patient recovered from the exploratory incision. Spiegelberg also found a subperitoneal myoma, which he enucleated, and an ovarian tumor as large as a hen's egg. P. Grenser had under observation for a long time a patient with a large solid tumor, while at the same

time a tense tumor was felt through the vagina. The autopsy disclosed a large fibroma of the uterus, and a perfectly smooth cyst of the right ovary, which completely filled the pelvis.

The leaving behind of instruments in the abdominal cavity by the operator, may be euphemistically called an unfortunate accident. It is probable that only the smallest number of such cases have been reported. The *Med. Times* for 1859 refers to a case of retention of a sponge in the abdomen. This also happened to Gustav Braun (the patient died in twenty-four hours), Bassini and Krassowski. Thornton afterwards removed a sponge which had been left behind; the patient recovered. This also happened in one of my operations, in which the usual nurse, who had been taken sick, was replaced by another one. I remembered that the sponge must be situated in the vesico-uterine fossa, opened the lowest two sutures in the abdominal walls, and removed the sponge with a volsella, an hour after the termination of the operation. The patient recovered.

Nussbaum met with the experience that a patient, in whom a large drainage tube had been inserted, but which was supposed to have slipped out externally, travelled home, and two months after the ovariectomy, drew the tube out of the abdominal walls, immediately after having passed a night at a ball.

Forceps, especially those of small size, are apt to be overlooked and left behind. One of my colleagues, an excellent operator, missed a pair of forceps after an extremely difficult ovariectomy. The patient recovered, returned home, and remained well for nine months. Then abdominal pains set in and terminated at the end of two weeks with the evacuation of a pair of forceps through the rectum. Spencer Wells left forceps in the abdomen on two occasions. In one case he extracted it half a day after the operation. It was found wrapped in the omentum after prolonged search by the exploring finger. In the second case the patient recovered. Four weeks after recovery from the ovariectomy a pair of forceps was found in the patient's bladder and extracted; this was followed by death. Spencer Wells states that the case is inexplicable to him, but the only conclusion possible is that the forceps gradually perforated the wall of the bladder.

CHAPTER XLI.

SIMULTANEOUS EXTIRPATION OF BOTH OVARIES.

OVARIOTOMIA DUPLEX.

IN a certain percentage of cases both ovaries are diseased at the same time. This occurs most frequently in malignant tumors and those which are closely allied to or combined with them, *viz.*, papillary cystomata. But even proliferating glandular cystomata and dermoid cysts are not very rarely bilateral, and necessitate bilateral extirpation. In malignant and papillary tumors the affection is not alone usually coincident, but is approximately uniform on both sides. This is exceptional in glandular cystomata. The affection of one ovary generally predominates while that of the other is only beginning, and, as a rule, is not recognized until after the extirpation of the former.

When the other ovary is inspected after an ovariectomy, it is not always easy to decide whether we have to deal with a beginning neoplasm, which renders extirpation advisable, or whether there is merely an unusual development of numerous follicles, on account of which the organ is enlarged two-fold or three-fold. The thin walls of the cysts and the clear, watery character of the contents are characteristic of follicular cysts.

If there is no doubt of the presence of a neoplasm, the second ovary, as a rule, is to be extirpated. But if the maintenance of ovulation and the ability to conceive are important, it must be remembered that functioning parenchyma may be present, even in advanced degeneration, and that pregnancy is possible. Hence, the organ is sometimes spared at the beginning of the disease. Spencer Wells was in doubt, during an ovariectomy, with regard to the removal of the other enlarged ovary, which contained two cysts as large as a cherry. He decided upon allowing it to remain. The patient afterwards married and bore four children.

In three cases in which the beginning neoplasm was recognizable, but the preservation of ovulation was very desirable, Schroeder resected the second ovary and closed the wound with a number of stitches, an admirable plan, which should be followed in similar cases if the isolated removal of the morbid parts and retention of the healthy parenchyma are still possible.

There is no doubt that both ovaries were formerly removed much less frequently than now. This is explained in part by the fact that the plan of examining the second ovary was not formulated in the early period of ovariectomy, and in part by the fact that those tumors which are most apt to be bilateral were not extirpated formerly. Spencer Wells had twenty-five bilateral operations among his first 500 ovariectomies, and fifty-seven among his second 500. Keith had thirteen bilateral operations among his first 229 operations, and nine among sixty-nine cases operated after January, 1880. The following more recent statistics furnish entirely different results.

Karl Braun among 84 operations				6 bilateral ones.	
Krassowski	"	128	"	21	" "
A. Martin	"	104	"	19	" "
Tauffer	"	59	"	14	" "
Thornton	"	130	"	32	" "
Howitz	"	62	"	9	" "
Olshausen	"	322	"	44	" "
<hr/>				<hr/>	
889				145 (16.3 per cent.)	

Under certain circumstances the second ovary should be removed even when healthy. It is particularly when fibroids are present that it may be indicated to take advantage of the opportunity of abolishing ovulation and menstruation.

The extirpation of the second ovary is made in accordance with generally accepted rules, and is commonly unattended with special difficulty. It is true that the small organ usually has not formed a real pedicle, but one may generally be made (by traction) of sufficient length to permit the secure application of a ligature. When this is impossible, we may aid ourselves by enucleation of the hilus. Clamp treatment was inconvenient in extirpation of both ovaries. The two pedicles were sometimes placed in one clamp, sometimes in two; or one pedicle was replaced in the abdomen, the other treated with the clamp. Even ardent advocates of clamp treatment will give the preference to reposition of the pedicle in double ovariectomy.

Double ovariectomy has been hitherto regarded as decidedly more unfavorable than the unilateral operation. The mortality of Spencer Wells's unilateral operation was 32.2 per cent., of his bilateral operations 34.1 per cent. In 1878 Koeberlé stated that about 12 per cent. of his operations were bilateral, and that only 50 per cent. of these cases terminated favorably. Thornton had a mortality of 15.6 per cent. in thirty-two double operations, and only 10.7 per cent. in his single operations. In my last thirty-six bilateral ovariectomies, the mortality was 5.5 per cent.;

in the 246 single operations performed during the same period the mortality was 10.2 per cent.

There is no question that the removal of the second ovary hardly makes the operation any more difficult and does not essentially increase the danger. But the fact that the most unfavorable tumors, from an operative standpoint, are most frequently bilateral, appreciably diminishes the chances of recovery.

CHAPTER XLII.

OVARIOTOMY THROUGH THE VAGINA.

THE case in which Thomas first carried out the idea of vaginal ovariectomy was that of a tumor as large as an apple, which had given rise to very disagreeable symptoms. The retro-uterine tumor was painful and readily movable, so that in the knee-elbow position it left the pelvis and appeared to be multilocular. After introducing a duck-bill speculum in the knee-elbow position, Thomas made an incision into the fornix and then incised the latter and the peritoneum, with one cut of the scissors. A gorget had been introduced five inches into the rectum. In dorsal decubitus the tumor was felt above the incision, and hooked; three cysts were then punctured in succession, and six to eight ounces of greenish fluid evacuated. The empty sac then followed the traction of the finger very easily and entered the vagina. The pedicle was now ligated in two halves in Sims's speculum in lateral decubitus and replaced; finally the vaginal wound was closed with silver wire.

The patient left the bed on the tenth day, but suffered from slight parametritis. She was entirely well at the end of two years.

Davis operated on a large tumor which lay, during pregnancy, partly in the abdomen, partly in the pelvis. Abortion occurred. Reposition of the tumor outside of the pelvis was attempted unsuccessfully, and it was then evacuated through the vagina with a trocar. At the end of five weeks the tumor was as large as before puncture (about the size of the uterus in the seventh month of pregnancy). An incision four inches long was now made in Sims's speculum, through the posterior vaginal wall. The tumor was found to be adherent, and was separated with the hand from the peritoneum anteriorly and posteriorly. It was then punctured, and the sac rapidly removed. The entire weight of the tumor was nine pounds. The pedicle was ligated in two halves. Recovery was uninterrupted.

Clifton Wing performed a more difficult operation in a feeble woman, who had been a great sufferer for many years. A retro-uterine tumor was found, but its character remained doubtful after two punctures, which had evacuated only blood. Hematocoele or ovarian cyst was suspected. After incision through the vaginal fornix and puncture of the tumor, a pedicle was found to be wanting. The tube and a portion of

the broad ligament entered the vagina with the sac. The tumor was enucleated; no ligature, no hemorrhage. Loops of intestines then appeared in the wound; reposition; suture. Catheter applied as drainage tube. Some foetid secretion first appeared, later pure pus. The patient recovered after a slight attack of fever.

Gilmore removed a tumor as large as an apple, and Thomas also successfully removed a normal ovary through the vagina. In another case, however, Thomas was unable to remove the painful, slightly enlarged ovary. The uterus and vagina were adherent to the rectum. Finally, the extirpation was completed with the aid of laparotomy. The patient died in fifty-six hours.

R. Battey has performed the operation most frequently, *viz.*, nine times on eight patients. In five cases he removed both ovaries at one sitting, in three cases only one ovary, and in another patient he subsequently repeated the operation. Two patients died after double ovariectomy. In all cases the ovaries were slightly enlarged or of normal size. Previously demonstrable tumors had not formed.

Battey operates in the following way: he introduces a Sims speculum in lateral decubitus, draws the uterus with a hook down to the rima vulvæ, and with a pair of scissors cuts the fornix in the median line for a distance of one to one and a half inch, beginning at the cervix uteri. If hemorrhage occurs (this is exceptional) it is checked by injections of ice water or torsion of the vessels before opening the peritoneal cavity. After incision of the peritoneum the operator enters the recto-uterine cavity with the finger, while an assistant pushes the pelvic organs from above downwards. After the first ovary is withdrawn with the aid of forceps, a ligature is placed around it, then the other ovary is drawn out, and they are then slowly removed with the *écraseur*. No ligature is required to check the hemorrhage. Finally, the vagina is washed out.

In two cases Battey found the ovaries surrounded by adhesions in such a way that they were recognized with great difficulty. In one this was only possible after partial mutilation of the organ and recognition of ovarian structure. In such cases Battey recommends the use of the sharp spoon in order to be able to ascertain what we have to deal with (!). In one case the forceps grasped a loop of intestines with the ovary and drew it out.

Baker and Girtzowt operated in suppurating dermoid cysts. In the latter case the cyst had already perforated into the vagina; the patient recovered.

On the whole, vaginal ovariectomy seems to have been abandoned quite generally in America, its Fatherland. It never met with approval in Europe. Mignon has collated from literature 113 cases with seventy-seven recoveries.

The difficulties and dangers of the operation are apparent. They

consist of injury to the rectum or small intestines, rupture of vessels and almost complete inability to check the hemorrhage, and the possible rupture of important organs, when adhesions which are invisible and cannot even be controlled with the finger must be divided, or when the pedicle is wanting, and the parts must be dragged forcibly into the vagina in order to divide them. To these disadvantages must be added the impossibility of carrying out strict antisepsis. The sole advantage is the position of the incision at the most dependent part of the peritoneal cavity, and, under certain circumstances, the more ready accessibility of the tumor from below.

We, therefore, agree with Peaslee when he says that the operation, on the whole, is not justifiable. It almost goes without saying, that large tumors should never be removed *per vaginam*. It is only in the rarest instances that the outcome would be as favorable as in Davis's case. But even in small tumors, whose size offers no obstacle to the vaginal operation, laparotomy is almost always preferable.

The tumor is either movable, and then can be removed by laparotomy without difficulty and with less danger, or it is immovable on account of adhesions or subserous development. In the latter event vaginal extirpation offers no certain prospect of success, because the difficulties can only be overcome by force.

We may conceive of cases in which vaginal extirpation is justifiable, but such cases are very rare. When a small, well defined tumor is situated on the posterior fornix, and has perforated the lumen of the vagina, the vaginal operation will come into question. Girsztowt operated successfully in a case of this kind, while E. Schwarz lost his patient.

The vaginal operation is also justifiable, perhaps, in exceptional cases in which, despite the absence of perforation of the tumor into the vagina, extirpation from above is made difficult by special circumstances, while the fornix is readily accessible. Perhaps, also, in those rare cases in which an ovarian tumor is situated entirely or in great part in a posterior vaginal prolapse.

Similar to such cases is one in which Stocks operated and which Goodell called *ovariotomy per rectum*. There was an apparent prolapse of the rectum, but the opening of the gut was found not at the lower end of the prolapse, but half way to the edge of the canal. The uterus was retroflexed. A body with band-like structures was felt in the prolapse. The incision disclosed an adherent cystic tumor, which contained five ounces and a half of a brown, viscid fluid. It was ligated and removed together with the adherent ovary and the tube. The patient recovered. The case seemed to have been one in which the retroflexed uterus caused a protrusion of the anterior rectal wall, in which the extirpated structures lay.

CHAPTER XLIII.

CONDITION OF THE PATIENTS AND AFTER-TREATMENT.

THE condition of the patients varies extremely, according to the diseases which follow the operation. The most frequent severe affection, *viz.*, septic infection, acts so much more decidedly on the general course of the symptoms after the operation, because it begins in the first twenty-four hours, and usually runs a rapidly fatal course, so that other disturbances, which are observed so often in cases of recovery, rarely develop.

CONDITION OF PATIENTS WHO RECOVER.

The symptoms observed in the first hours after ovariectomy, are those of depression or collapse, occurring as the result of the prolonged narcosis, the exposure and cooling, and sometimes of the loss of blood.

The patient is usually pale, even if there has been no notable hemorrhage, has a small, soft, occasionally frequent, more rarely slow pulse; after severe hemorrhages the pulse is always rapid. The temperature of the surface of the body is almost always lowered, usually 36 to 37° in the axilla, but often considerably lower. I have repeatedly seen temperatures of 35° , and once 33.9° . As a matter of course, this will be influenced by the temperature of the room during the operation, the more or less careful covering of the patient, and the use of the spray. The temperature does not long remain subnormal; it almost always reaches the normal, and often exceeds it, within six to twelve hours.

In the first few hours there is no marked thirst, except after considerable losses of blood. Nausea and vomiting often occur during the first six hours, in other cases not until the next day.

The patients rarely complain at first of pains in the abdomen.

Even in cases of recovery, a complete apyrexial course in the first few days is exceptional. Among eighty recoveries the temperature never exceeded 38° in fifteen cases, 38.5° in forty-one cases. In eight cases the temperature reached 39 to 39.7° . These statements refer to the first four days after the operation.

The elevation of temperature is to be regarded as surgical fever in the broad sense of the term. It is due to the absorption of products of degeneration without septic properties, and not to peritonitic irritation.

As a rule, peritonitis does not occur in cases which recover. The more the decomposition of the abdominal contents is prevented, the more probably will the fever remain slight, but in my experience it is not entirely absent even in those cases in which, after strict antiseptis, the course of recovery is uninterrupted, and no inflammations are observed. Fränkel has recently reported two cases of high temperature after ovariotomy. Both patients recovered. The prolonged duration of the fever, which reached a maximum of 40.7° on the fourth day in the second case, and remained almost constantly at this height until the ninth day, might have aroused the suspicion of sepsis, but this was opposed by the slight frequency of the pulse (eighty-four constantly) and the absence of peritonitis.

The temperature is raised most frequently and most markedly when the tumor has been complicated with ascites.

The frequency of the pulse usually corresponds with the increase in temperature, but as a rule, it remains moderate and rarely exceeds 100 a minute. The general condition is also impaired by high temperatures; sleep is poor and there is annoying thirst. But the absence of danger is shown by the general condition within the first twenty-four hours, and, in the majority of cases, even at the end of twelve hours. If, after an initial moderate rise of temperature, the latter falls ten to twelve hours after the operation, the frequency of the pulse remains moderate and the expression of the face normal, and the subjective feeling is satisfactory, the danger of sepsis, and, as a matter of course, of shock, is almost always past. But this offers no guarantee against the dangers impending from other causes. The latter are so rare, however, that they need not be considered.

It cannot be denied that in some cases slight, circumscribed peritonitis may be the cause of fever in the first few days. But such cases are exceptional, especially after strict antiseptis. In the latter the complete absence of local reaction is as constant as it is striking. It is true that the abdomen cannot be palpated and inspected through a firm bandage, but even moderate tympanites would be manifested by great tension, dyspnoea and pain. These symptoms are rarely observed. When the first dressing is renewed after a longer or shorter period, the complete absence of reaction in the wound, the flabbiness of the abdomen, which presents the same deep folds that it did immediately after the operation, are agreeably surprising. At the most we find slight tenderness of one or the other hypogastric region, which need not be explained by the assumption of a peritonitis.

But other causes of febrile movement may appear at a subsequent period. Formerly the most frequent ones were inflammatory processes in the abdominal walls. These start from the tracks of the abdominal sutures, or, in other cases, from the opened sheaths of the recti muscles or from sepa-

rated portions of the peritoneum of the abdominal walls. Prior to antiseptics these phlegmons constituted a frequent and very annoying complication of laparotomy, and not uncommonly delayed recovery for weeks. With the introduction of Listerism they disappeared almost at once. Among more than 200 laparotomies in the last few years I have seen only a single case of phlegmon. It is only in rare cases that a suture track suppurates. In the majority of cases not a single drop of pus is seen on removal of the sutures. The most important factor in the prevention of this complication, is thorough disinfection of the suture material. But the protective bandage is not unimportant, although it may be replaced, to a certain extent, by iodoform.

The suppuration of the suture tracks and the formation of larger, præperitoneal exudations may give rise to fever at various periods. It sometimes begins on the fourth or fifth day after the operation, and may then be directly continuous with the primary absorption-fever. But the suppurative fever is usually preceded by a short period of apyrexia, or, at least, by a distinct fall of temperature. In cases which go to the other extreme, the fever from phlegmon of the abdominal walls does not develop until two weeks after the operation or even later. Thus, in a patient whose temperature had remained below 38° for six days, and who had not yet left the bed, fever again began on the fourteenth day, rose to 39.7° , and did not cease until the twenty-first day after the operation. The cause was soon found in an exudation in the abdominal walls, in the shape of a hard, tender tumor, half as large as a fist. This disappeared rapidly after the cessation of the fever. Absorption, however, is a rather rare exception.

In another quite unclean operation upon a myxoid cystoma which had previously ruptured, a rise of temperature to 39° (with strict Listerism) occurred on the second and third days. After the fifth day the temperature remained permanently below 38° , and the patient had left the bed when fever again appeared on the eighteenth day; this resulted from exudation and subsequent suppuration in the abdominal walls. The fever persisted continuously for three and a half weeks with a temperature ranging to 40° .

The suture tracks are almost always the starting-point of these exudations and suppurations; in using Koeberlé's peg stitch, they almost always begin in the tracks of the latter. But this does not offer any valid reason for its discontinuance. They form the starting-point merely because they are allowed to remain longest, in the same way that, after application of interrupted sutures, the deep ones suppurate because they are removed last.

The duration of the fever depends on the extent of the inflammation and the more or less rapid evacuation externally. This takes place through the suture tracks or the usually healed abdominal wound. The

latter is annoying in so far as it often delays the healing of the abdominal wound for weeks, causes the cicatrix at this part to become broader, and predisposes to the formation of a hernia.

More pronounced febrile conditions are also produced by intra-peritoneal abscesses or by the suppuration of remnants of the cyst, which could not be removed, and which had been connected with the surface of the abdominal walls. I have very rarely seen intra-peritoneal abscesses after ovariectomy. The abscesses develop with the symptoms of circumscribed peritonitis, usually of the pelvic portion. In many cases the exudations can not be recognized positively by exploration, especially as bimanual examination can not be made in the first period after the operation. The purulent or ichorous deposits rupture very often into the rectum, less frequently through the abdominal walls or into the bladder. The evacuated fluid not infrequently contains necrotic shreds of tissue or a ligature, an evidence that the inflammation started from a ligated portion of tissue. The ligated portion of the pedicle is most apt to come away.

In a patient aged thirty-five years, Hegar extirpated a cystoma, as large as a child's head, and which was free from adhesions. As a pedicle was lacking, the posterior layer of the broad ligament, upon which the tumor was situated, was ligated on both sides by a double ligature carried under the tumor, and the latter was then removed. Febrile movement, but not marked; an abscess as large as a walnut around a suture track; jaundice lasting a week; gastric disturbances. On the sixteenth day a membranous piece of tissue 12 cm. long and 3 to 6 cm. broad, with a ligature knot, was discharged per rectum with a soft evacuation. Then marked improvement and recovery.

In another case Hegar had extirpated a suppurating, totally adherent dermoid cyst, ligated the hyperplastic omentum *en masse* and left part of it upon the tumor, and had applied about thirty ligatures. An extra-peritoneal exudation, which suppurated, first formed at a spot corresponding to a separation of the parietal peritoneum. On the eleventh day it burst through the abdominal cicatrix, discharging foul-smelling pus. The abdominal cicatrix was reopened from the umbilicus to the lower angle of the wound, in order to get a better view of the conditions, and a hard painful nodule was discovered deep down, above the symphysis. On the seventeenth day rupture of this nodule with discharge of the necrotic tissues and a ligated portion of the omentum with three ligatures. On the twenty-first day discharge of another piece of tissue with ligatures; on the next day evacuation of shreds of tissue in the stool; temperature 40°. On the fifty-first and fifty-seventh days, pus again discharged per rectum, once with three ligatures. Pyrexia after the thirtieth day. The patient recovered.

In a third case Hegar observed evacuation of pus per rectum (without ligatures), attended with considerable fever.

These abscesses,* which perforate the intestines, undoubtedly occur more frequently than they are observed, and are probably a cause of fever in the second or third week, whose origin is not always clear. Thus, in a patient in whom I had extirpated a cystoma of both ovaries, weighing 30 kilo., fever appeared on the twentieth day, although the temperature had not exceeded 38° since the fifth day. It rapidly rose to 39.8° without any demonstrable local disturbance. The fever disappeared permanently at the twenty-second day with the evacuation of a copious, extremely foetid stool. Ligatures or shreds of tissue were not noticed in the evacuation, but they were probably present, and the cause of a latent perforating abscess.

Thomas noticed the passage of a silk ligature of the pedicle through the bladder three months after ovariectomy. Small abscesses may develop without febrile movement. Thus Loehlein describes the extirpation of a bilateral papillary cystoma, and the evacuation of silk threads per rectum on the twenty-fifth day, without any previous febrile movement.

Reference has already been made to the case described by Hueffell, who, twenty months after an ovariectomy performed by Hegar, observed the formation of an abscess which discharged through the abdominal cicatrix. The exciting cause was probably parturition, which occurred six weeks before. This case is unique; the usual period of development of intra-peritoneal and extra-peritoneal abscesses is the second and third week.

Febrile parotitis occasionally appears after ovariectomy. It may occur independently of septic processes, as the sole affection after the operation. It is either unilateral or bilateral, often attended with considerable fever, and terminates in resolution or abscess. It generally appears on the fifth to seventh day after ovariectomy. I observed the following case:

A patient aged forty-three years, who had been very much reduced by severe pleurisy with profuse exudation, had undergone the operation of ovariectomy six days after apyrexia set in; cystoma weighing twenty-eight pounds; parietal, omental and intestinal adhesions; operation without special difficulty. Apyrexial course for first four days; on the fifth day, sudden rise of temperature (39.7°) with painful swelling of both parotids. It resolved in four to five days after rapid defervescence. No other complication occurred, and investigation regarding an epidemic origin was attended with negative results. The patient had suffered from a bed-sore, however, during her previous severe illness.

Möricke reported five cases of parotitis, beginning on the fourth to seventh days. Abscesses formed in three cases. One occurred in a pregnant woman, in whom double ovariectomy was performed; the unilateral parotitis resolved, and the patient recovered, but premature delivery set in. One of the patients died on the ninth day, after the parotid abscess had been opened on the previous day. Suppuration of the abdominal

walls occurred in one of the other cases, and a third had suffered from decubitus. Möricke denies the epidemic origin of his cases, or their connection with septic disease. But in the absence of an autopsy on the fatal case, we may think of the possibility of sepsis.

Other less important conditions, some of which run an apyrexial course, may also make their appearance. These include intestinal colic, which may develop in the first few days after the operation, even before the patients have taken any nourishment. The often very annoying spasmodic pains occur with or without nausea, usually without fever, but occasionally with a rapidly subsiding rise of temperature. Some cases are simple flatulent colic from retention of fecal masses, in others intestinal irritation appears to result from the operation, for example, after separation of intestinal adhesions. In one case I observed colic during the first few days after extirpation of a large myxoid cystoma, in which the intestines had not been adherent. It lasted for weeks, often with great severity. The bladder and sphincter ani were occasionally in a condition of painful contraction. Peritonitis did not develop. The colic had not ceased at the discharge of the patient, six weeks after the operation.

Mention must also be made of the usually mild catarrh of the bladder. It occurs in certain patients, after they have been regularly catheterized for a time. It often produces very little or no disturbance, and generally ceases spontaneously after the discontinuance of catheterization.

The origin of these vesical catarrhs undoubtedly results from the introduction of vaginal secretion into the bladder, as is seen much more frequently in the puerperal condition. Hence, catheterization should not be performed unnecessarily after ovariectomy, and should not be continued longer than necessary. During the first twenty-four hours diuresis is usually very scanty, and the first evacuation of the bladder may generally be delayed until twelve to twenty-four hours after the operation.

Finally, not a few patients suffer from uterine hemorrhage in the first days after the operation. This is not to be interpreted as menstrual, since it appears independently of the menstrual period. It generally occurs on the second or third day after the operation. It may be quite abundant, but is never profuse or prolonged. I believe that it occurs in one out of every four or five cases. It is probably the result of collateral fluxion, which must occur in the vascular tract of those main arteries which supplied the extirpated tumor with blood. If this explanation is correct, the hemorrhage should be observed particularly after the extirpation of large tumors, and this agrees with my experience. I observed uterine hemorrhage after extirpation of a twenty-four pound and twenty-six pound tumor, and a double ovariectomy in which both tumors weighed sixty pounds; in one case, however, it occurred after extirpation of a sarcoma weighing six and a half pounds. The hemorrhage does not re-

quire treatment, but it should be taken into consideration with regard to catheterization. It is not improbable that cystitis is more apt to occur when the vulva is moistened with a bloody, easily decomposed fluid. The occurrence of this hemorrhage, and particularly of early menstruation after ovariectomy, is preceded not infrequently by various disturbances and a moderate rise of temperature (menstruation fever). Pains in the back and abdomen, insomnia, restlessness and malaise may last a day, and rapidly disappear after the onset of the hemorrhage.

In cases which run an approximately normal course, an expectant plan of treatment is to be adopted. Complete bodily and mental rest, and rest for the intestinal canal are the sole desiderata, so long as pathological symptoms are absent. A large airy room, a good mattress, an intelligent and well-trained nurse, are the chief requisites. As the temperature is almost always subnormal at first, the patient should be warmly covered, and the bed kept warm by warming-pans. Rest for the intestinal canal is best secured by introducing nothing, literally speaking, into the stomach. Not even a swallow of water should be given in the first six to twelve hours. Pieces of ice stimulate peristalsis even more than water, and should therefore be avoided. If the patient suffers from nausea, a drink of water is apt to produce vomiting. Nausea should first be combated by placing the head lower. Although there may be no indication for therapeutical interference, we should be as careful as possible with regard to the patient's nourishment. Cold black coffee is best retained in conditions of nausea. The majority of patients have very little appetite for days, at least, after prolonged narcosis. When the appetite returns, we should first give food which leaves but little *débris* in the intestinal canal. Flatulent substances should not be given for many weeks, to avoid stretching of the recent abdominal cicatrix by distension of the abdomen.

With a diet of this kind the desire to go to stool rarely appears before the end of the first day, the abdomen is not distended, and there is thus no indication for producing an evacuation from the bowels. This is based on the assumption that the intestines have been thoroughly evacuated by laxatives, and finally by a copious enema daily for several days prior to the operation.

Abdominal straining during the first few days may result in the opening of a ligature, and perhaps a fatal hemorrhage, as Billroth observed a few hours after extirpation of the spleen.

If the above suggestions are carried out, it is unnecessary to give opiates in order to secure rest for the intestinal tract. This should be avoided whenever possible, since it causes great difficulty during the first evacuation from the bowels, on account of the hardness of the faecal masses. Abundant enemata or internal cathartics must then be administered for days; fever develops not infrequently, and at least very annoying colic which often lasts for days.

When colic develops in the first few days, small doses of morphine are usually very effective. Some writers recommend the introduction of a canula into the rectum. The same effect is produced in such cases by an early enema of warm water or tea. The patient usually experiences rapid relief with the passage of flatus.

When the condition of the patient is not entirely normal, certain therapeutic measures are requisite. The pulse and countenance of the patient furnish important signs. If the collapse appears serious, it is treated by warm applications, injections of ether, enemata of wine, low position of the head, and if the patient has come out of the anaesthesia and is able to swallow, by alcoholics and musk. If it is probable, from the course of the operation, that blood is still trickling from divided adhesions, and that this aids in the production of collapse, a firm abdominal bandage should not be neglected. Nussbaum places a brick weighing eight to nine pounds, if necessary, upon the patient's abdomen. Warm wrappings around the limbs are an important aid after profuse losses of blood during the operation.

As a rule, the collapse is so far relieved in a few hours, that no apprehension concerning it need be entertained. But this is not always true. One patient, in whom a tumor weighing more than 25 kilo. was extirpated with difficulty, on account of general adhesions, but without any notable loss of blood, had an axillary temperature of 35.4° after the operation, but no signs of collapse. The temperature rose in a few hours to 37.5° , but fell on the ensuing day to 36.5° , with a pulse of 130, and the patient evidently in collapse. A secondary hemorrhage could not be assumed, because no blood escaped through the vaginal drainage tube. Champagne was given freely with $\frac{3}{4}$ gm. of musk and ether subcutaneously, and the temperature soon rose to 37.7° , while the frequency of the pulse diminished. The patient recovered.

The vomiting after narcosis requires therapeutic interference more frequently than the symptoms of collapse. Except in rare cases the patient vomits once or more in the first twenty-four hours after morphine-chloroform narcosis, while this occurs very rarely during the operation itself. According to Spencer Wells, vomiting is much less frequent after the administration of methyl bichloride, and this is corroborated by my own experience in thirty cases.

Although the vomiting does not cause serious injury, it cannot be denied that it must favor the oozing of blood from the raw surfaces, that it may lead occasionally to the tearing out of a ligature, that it increases peristalsis, may prevent the encapsulation of deleterious substances which have entered the abdominal cavity, and may favor their diffusion in the peritoneal cavity. In addition to absolute rest and complete deprivation of fluid, injections of morphine in the region of the stomach are the best remedy against vomiting. Pieces of ice, cold coffee, champagne, etc.,

rarely produce good results. If there is great thirst—drinking is to be eschewed on account of the vomiting—we may give enemata of lukewarm water, which quench the thirst better than mouthfuls of water.

When fever sets in, the question always arises during the first few days whether it may not result from septic infection or localized inflammatory processes. In either event the treatment must be expectant, until the question is definitely settled. We will soon see how successful local measures sometimes are in the treatment of septic processes. General treatment in such cases with alcohol, quinine, salicylates, cold baths, etc., will be discountenanced by all. But it would also be useless in such cases to treat a local peritonitis by local or general antipyretic measures. The circumscribed peritonitides after ovariectomy are due to the contact of the peritoneum with inflammation-producing substances, whether they consist of the infected stump of the pedicle, pieces of solid tissue which have been left behind, irritating fluids, or ligature material. We can only hope that the deleterious substances may be encapsulated, and the peritonitis remain circumscribed. This can be aided by abolishing peristalsis and thus favoring the formation of adhesions around the primary inflammatory focus. Hence, narcotics in large doses constitute our sole therapeutic agent. Local abstraction of blood, ice compresses, poultices and all other internal treatment are injurious.

In conclusion we must discuss the measures demanded by certain forms of operation. After clamp treatment the stump of the pedicle must be carefully watched, especially on account of the possibility of gangrenous degeneration. This can be surely prevented by coating with liq. ferri sesquichloride, or ferrum sulph. cryst., or dusting with benzoate of soda, iodoform, salicylic acid, etc. When decomposition sets in there is danger that the gangrenous products will pass along the pedicle into the abdominal cavity, and there produce inflammation or septic infection. For this reason Spencer Wells closes the abdominal wound tightly around the pedicle. Others do not do this, and regard this danger as very slight. As a rule, the pedicle in front of the clamp mummifies if the pedicle has been forcibly compressed. But if gangrene does set in the danger of septic infection is not very great, because the peritoneum adjacent to the abdominal wound is usually covered with granulations, and, therefore, absorbs poorly.

As the slipping of the pedicle into the abdomen is to be feared if the gangrenous stump in front of the clamp is cut in the first few days, the abdominal cavity must be protected as well as possible against the gangrenous matters.

The clamp rarely drops off before the seventh day, sometimes not until the fourteenth day or even later. In order to get rid of the clamp (which covers the wound) in such cases, it is sometimes advisable to cut the last threads of the pedicle below the clamp.

After the instrument has fallen off, the pedicle retracts more or less and draws the abdominal walls after it, often in such a way as to form a deep funnel. If the stump of the pedicle is healthy, this condition is immaterial, since secondary hemorrhages are no longer to be feared. But if gangrenous portions were present below the surface of division, as may happen when ligatures have also been used, we have to deal with a gangrenous mass, which is often situated deep in the abdomen. In a case of this kind I observed fever lasting two weeks after the operation. The fever ceased when all the gangrenous shreds of the pedicle had been exfoliated or removed from the depths of the wound. Vaginal drainage had been employed, and the tube was allowed to remain until defervescence. The partial reopening of the abdominal wound may be necessary in such cases.

After the removal of the clamp the wound, as a rule, heals rapidly. The adjacent loops of intestines have long been covered with granulations, are often adherent to one another and to the abdominal walls, and have thus excluded the funnel-shaped space from the peritoneal cavity, even before the clamp is removed.

With regard to the removal of the sutures, I would urgently advise that the deep ones, at least, should not be removed before the tenth day, and not before the first evacuation from the bowels. In some cases, especially after the use of opium, and even in the absence of peritonitis, there is such an enormous distension of the abdomen before the first evacuation, that no recent cicatrix, however well the sutures had been applied, could resist the pressure. In a case of this kind in which, fortunately, two peg stitches were still *in situ*, I was expecting for twenty-four hours that the cicatrix would burst at any moment, and that the distended intestines would be completely prolapsed. If this had happened, the reduction of the enormously distended gut would have been impossible without puncture.

I now remove all the sutures at the end of ten days, and then fortify the still yielding cicatrix by broad strips of adhesive plaster, which the patient wears four or five weeks after the operation. When the abdominal wound is completely closed, the dressing is allowed to remain until the removal of the sutures, and is then replaced by a wad of cotton fastened with adhesive plaster.

The reopening of the abdominal wound is a very serious accident. In former times it was almost always fatal. Spencer Wells observed four cases, in all of which death resulted. Thanks to antisepsis, almost all recently reported cases have terminated favorably. Buentzel mentions three cases in Spiegelberg's practice, in all of which catgut sutures had been used. In the first case they were removed on the sixth day. On the seventh day, after removal of the dressing, the loops of intestines appeared. In the second case rupture occurred on the tenth day during a

coughing spell; the sutures had been removed on the eighth day. In the third case rupture occurred on the fourth day, before the removal of the sutures. Wahl operated during the third month of pregnancy. The sutures were removed on the eighth day, and on the ninth day the entire abdominal wound opened under the dressing. Fresh sutures; recovery without abortion. Menzel reports a fatal case. The patient, who suffered from severe cough, left the bed nine days after removal of the sutures. Death occurred two days later. Ask observed fatal rupture of the wound on the twelfth day, during a coughing spell. In Croft's case rupture occurred while vomiting, the sutures having been removed eight days before. The wound healed by granulations. Sutures do not seem to have been inserted in this case, although the loops of intestines were exposed.

Among 380 laparotomies I observed opening of the abdominal wound in two cases. Both occurred in myomotomies. In the first case all the sutures had been removed on the eighth day, and an adhesive plaster dressing applied. On the eleventh day the patient left the bed, sat upon the night vessel and strained. The upper half of the wound at once ruptured and a part of the omentum, as large as a fist, prolapsed. After cleansing and reduction of the omentum the wound was closed with silk sutures; Lister dressing. Rise of temperature (38.6°) on the following day; then uninterrupted recovery.

In the second case the patient was carried, on the twelfth day, to another floor of the hospital although the strips of adhesive plaster had not been examined. The intestines were found prolapsed after the transportation. Freshening of the wound and fresh sutures; undisturbed recovery.

It is evident from these cases that premature removal of the sutures or improper suture material (catgut) or vigorous abdominal straining was often the cause of rupture. Upon what Kaltenbach bases his opinion that it rarely results from such mechanical causes, but is due to infection of the edges of the wound, which have not united by first intention, I do not know. At all events the literature of the cases is decidedly opposed to such an interpretation.

On account of the distensibility of the recent cicatrix, it is not advisable to allow the patient to leave the bed before the fifteenth day. Howitz keeps the patient in bed for three weeks. To permit her to leave the hospital on the fifteenth day, as is sometimes done, I regard as a dangerous indiscretion. During the first few weeks the patient should not get up unless the abdominal walls are drawn together by strips of adhesive plaster. In addition she should wear a firm abdominal bandage of dimity, or a rubber bandage for a year after the operation.

CONDITION OF PATIENTS WHO DO NOT RECOVER.—CAUSES OF DEATH AND POST-MORTEM APPEARANCES.

Under this heading we will discuss deaths from shock, hemorrhage, septicæmia and peritonitis, intestinal occlusion, tetanus, embolism, exhausting suppuration, and accidental complications.

Shock proves fatal most quickly. The factor in shock which threatens life is the failure of the heart. Various conditions in ovariectomy may unite to favor the occurrence of shock, *viz.*, the loss of blood, narcosis, mechanical irritation of the abdominal viscera, especially the intestines, and the diminution of the bodily temperature.

Wegner concludes, from his numerous experiments, that the chief stress is to be laid on the last-mentioned factor, and explains the often considerable diminution of the bodily temperature by the peculiarities of laparotomy. These consist in part of the exposure of the trunk, often for a long time, and still more the exposure of the peritoneum, which may be very protracted and extensive in difficult operations. It has been calculated that the area of the entire surface of the peritoneum is approximately equal to that of the body. Although this entire surface is not exposed, it must be remembered that the moist surface, covered merely with thin endothelium, will give off heat much more readily than the skin. This predisposition is increased considerably during the operation, by the arterial congestion which rapidly occurs after opening the abdominal cavity (from the diminution of the intra-abdominal pressure) and is distinctly manifested by the rosy color of the intestines. To this arterial congestion is subsequently added venous congestion, produced by paralysis of the intestinal walls as the result of their cooling. The loss of heat on the part of the peritoneum is, therefore, very great. Wegner's observations are supplemented by Maas's experiments, which show that the loss of water by the blood is very great when the abdominal cavity is opened. But the production of heat diminishes with abundant losses of water, and the body grows cool.

These observations explain the considerable depression of temperature which is observed so often after ovariectomy. There can be no doubt that this increases the shock. But the question arises whether other factors are not even more effective. Werth attributes much greater effect in the production of shock to the loss of blood than to the cooling from exposure of the peritoneum; next in potency, according to him, stands the duration of the narcosis. Werth observed depression of temperature, similar to that in laparotomies, after protracted vaginal operations and total extirpations of the uterus.

It is very difficult to arrive at a positive conclusion concerning the significance of the individual factors. But Werth's view appears to me to be correct in those cases, at least, in which the operation is performed.

when the patient is already anæmic, as occurs particularly after intracystic hemorrhages. But whether this opinion is valid generally seems to me to be doubtful. In the large majority of ovariectomies, the loss of blood is slight, and yet the temperature fell, in three-quarters of the cases, below 36.5° , in one-third of the cases below 36° . From the observation of my cases the temperature of the surrounding air, for example, appears to me, contrary to Werth's opinion, to exercise considerable influence. Moreover, the influence of the length of the operation is not to be underestimated, though it must remain undecided whether more depends on the prolonged narcosis or on the operation itself.

According to my experience, finally, the manipulations in the abdomen, especially on the intestines, exert a very pronounced influence. Gutsch's experiments, made under Goltz's direction, showed that irritation of the viscera and diaphragm diminished the blood pressure forthwith, that this rises with the subsidence of the irritation, but does not reach its former height. The effect is more marked, the longer the peritoneum has been exposed. This agrees with our experience in the living subject. Prolonged and energetic manipulation of the intestines during laparotomy, has a noticeable influence on the pulse. A still more injurious effect is produced by the injection of large amounts of fluid into the abdominal cavity. During injections of warm solutions of thymol ($\frac{1}{10}$ per cent.) I have seen a bad effect on the pulse and syncopal conditions so frequently, that there can be no doubt as to the relation of cause and effect. In several cases, indeed, the evidences of shock were so pronounced that, despite immediate treatment, the shock persisted and terminated fatally.

A. Martin's statement that the placing of the intestines upon the abdominal walls (which he does in 90 per cent. of his ovariectomies) is entirely innocuous, appears to be at variance with the above statements. But it is perhaps less dangerous to grasp and displace the intestines once, although forcibly, than to expose them to prolonged manipulation.

The frequency of death from shock after ovariectomy is determined with difficulty, and it probably varies with different operators, inasmuch as the mode of operation undoubtedly exerts an influence. Older statistics are useless, because cases of acute septicæmia were formerly regarded as shock. Spencer Wells's tables show thirty-eight deaths from shock or "exhaustion" among his first 800 operations. But a glance at the tables shows that the majority must have been cases of septicæmia. This is undoubtedly true of the last case, No. 782, (death on the sixth day) which is placed between two deaths from septicæmia. In the last 200 cases not a single death from shock or "exhaustion" is reported.

Among Keith's first forty-two cases there were five deaths within the first two days; then there was no death in the first three days until the 200th case.

Among 282 ovariectomies I had seven deaths from shock, five cases in the first half, two in the second half. Death occurred three times within the first five hours, in three other cases within fifteen hours, and once at the beginning of the second day. The first five cases included four in which a solution of thymol had been poured into the abdominal cavity during the operation. Three cases occurred in very difficult enucleations of subserous tumors. Of the two cases in the last hundred, one patient suffered from general peritonitis with extensive purulent exudation, and a tumor which had become gangrenous after puncture. The patient entered the hospital in this condition, and on the day before the operation fell into profound collapse with complete pulselessness from which she was saved only after artificial respiration lasting half an hour. She died one and a half hours after the termination of the operation. The other case was one of very vascular cysto-sarcoma of the ovary, which was separated with difficulty, and after great loss of blood from the mesentery and intestine, which was intimately adherent for one metre.

In addition to the seven deaths from shock, there were three deaths from exhaustion on the seventh, eleventh and twenty-fifth days. All three occurred after difficult enucleation of subserous tumors in very feeble individuals. One of these patients, aged sixty-four years, did not eat anything after the operation. She died seven days later, and the autopsy merely showed a striking dryness of all tissues. The second patient died under similar circumstances, but a very circumscribed peritonitis was found on autopsy. The third died on the twenty-fifth day after profuse diarrhoea lasting ten days.

The term "death from shock" should be applied only in those cases in which the patients do not come to after the operation, but remain until death in a condition of constantly threatening collapse.

The prophylaxis of shock is not unimportant. Acceleration of the operation, sparing use of chloroform during protracted operations, avoidance of unnecessary loss of blood and heat, and of irritation of the intestines are the conditions which the operator should endeavor to secure. While special precautions are unnecessary in young and vigorous individuals, they are very useful in old, decrepit or very anæmic patients. In cases of the latter kind I operate with the room at a high temperature (25 to 30° C.). Noeggerath endeavors to prevent loss of heat by placing the patient upon a very warm water-bed during the operation. At all events the limbs must be well covered.

The therapeutic measures recommended for collapse may be employed after shock has appeared. The question of transfusion of blood or a solution of salt (0.6 per cent.) may also arise.

Considerable hemorrhages after the completion of the operation almost always come from the pedicle. Fatal hemorrhage has been observed after all forms of treatment of the pedicle, but most frequently after ligation

and replacing. Even at the present time this is regarded by some as the main objection to this plan of treatment.

In the majority of cases secondary hemorrhage from the pedicle occurs on the first or second day, though they are sometimes observed at a much later period. In some cases vomiting or some other abdominal strain gave rise to the hemorrhage by loosening a suture. In rare cases secondary hemorrhage has taken place from the raw surfaces of divided adhesions.

The following cases may serve as illustrations:

Moselig ligated the pedicle and fastened it with Petit's needle. The patient died on the third day, and 500 grm. fresh blood were found in the abdominal cavity.

Solly observed severe secondary hemorrhage on the day after the operation. The abdominal wound was reopened. The ligature had slipped from the pedicle, and the abdomen contained 17 grm. blood. The patient died during the second operation.

Stilling lost a patient on the fourth day from hemorrhage from the pedicle. Netzel lost a patient on the fifth day; the autopsy showed peritonitis and one kilo blood in the abdomen.

The secondary hemorrhage is not always fatal, and is sometimes relieved by energetic measures.

Charles Clay ligated and replaced a very thick pedicle. On the second day severe hemorrhage occurred from the lower angle of the wound, Clay reopened the wound and again ligated the pedicle. The patient was saved although a violent peritonitis set in.

In Spencer Wells's thirty-ninth ovariectomy the thin pedicle was ligated with wire and stitched into the wound. Considerable hemorrhage five hours after the operation. The source of the hemorrhage was not clear, but it appeared to come from the part at which the wire had cut in; Wells ligated the short pedicle in three parts, but during this time the patient fainted. A retro-uterine hæmatocele had formed, and gradually became more distinct. It was punctured and discharged eight ounces of dark, foetid fluid. The patient recovered.

Köberlé had treated a short pedicle with his compass clamp. This was taken off on the fourth day and the remains of the pedicle removed on the eleventh day. On the following day hemorrhage from an artery in the retracted cicatrix. It ceased after the application of styptics, but recurred with violence on the following day. Köberlé now dilated the wound to a width of 10 cm. by means of two fingers introduced into the wound funnel, and compressed the ovarian artery, at first with the fingers, then with a pair of forceps which were allowed to remain five days among the loops of intestines. The abdomen was cleansed of clots, and the patient recovered.

Scott adopted an unusual mode of treatment. After a difficult operation profuse hemorrhage occurred through the drainage tube on the sixth day. This increased on the next day, and three drachms tincture of iodine (!) were injected into the abdominal cavity through a rubber tube. The hemorrhage ceased and the patient recovered.

Hemorrhage from other sources is rarer. Clay lost a patient from the gradual oozing from divided adhesions. Peaslee lost a patient four hours after the operation. The autopsy showed rupture of a venous plexus on the proximal side of

the ligature of the pedicle. No hemorrhage had been noticed on closing the abdominal wound.

Bayless saw a fatal hemorrhage from an artery of the abdominal walls, twenty hours after the operation. The abdomen contained two quarts of blood.

Spiegelberg enucleated an intra-ligamentary ovarian tumor and ligated numerous vessels. The patient bled to death in twenty-three hours.

Berne fastened the pedicle with perforating lance-tipped needles into the lower angle of the wound. On the fifth day the angle of the wound ruptured and the patient rapidly bled to death.

One of Bryant's patients died on the day after the operation. The abdomen was found full of blood, but the pedicle was well secured by the ligatures. Bryant assumed that the blood was derived from an artery of the false membranes.

Köberlé controlled a violent hemorrhage from the pedicle, which appeared on the ninth day, by means of compression of the pedicle through the abdominal walls.

The much greater frequency of hemorrhages from the pedicle in former times was owing to the fact that the pedicle was always ligated *in toto*, not in parts. As a matter of course, this is of the greatest importance in applying ligatures. The remarks made previously with regard to technique may also be referred to. Reliance on wire constrictors alone seems to be especially dangerous, because the pedicle soon becomes thinner under the pressure of the wire, and then the unyielding wire loop no longer exercises compression. This is not true of silk, hemp or catgut. In the majority of cases the proper treatment will be the reopening of the abdomen and exploration for the source of hemorrhage, provided that there is no doubt of internal hemorrhage.

Septicæmia and Peritonitis.—The immense majority of deaths in the first week after ovariectomy are the result of septicæmia. Marion Sims first showed that the presence or absence of peritonitis exerts comparatively little influence as regards the fatal termination, and that septicæmia often runs its course without peritonitis. We may also agree with Sims that the presence of a decomposing fluid in the peritoneal cavity is to be regarded as the cause of septic infection, but we do not hold that the mere presence of this fluid is a proof of septicæmia. The proofs of the existence of septicæmia are to be found in the combination of phenomena, the clinical history, very often in the absence of local lesions, which can be regarded as the cause of death (as shown on autopsy), and occasionally the discovery of positive appearances in the dead body. Peritonitis is very rarely the direct cause of death, although it probably accelerates the fatal termination in septicæmia. Peritonitis and septicæmia after ovariectomy are to be regarded as the effects of the same cause. The decomposing contents of the abdominal cavity irritate the peritoneum, and at the same time, produce more or less acute symptoms of sepsis as the result of absorption. It usually, though not always, terminates fatally. The exudation of peritonitis, mingled with the usually bloody fluid derived from the operation, rapidly undergoes decomposition, becomes ichorous, and

increases the putrid poisoning when it undergoes partial absorption. The peritonitis may prove directly fatal on account of the meteorism, the upward displacement of the diaphragm and the consequent insufficiency of respiration. But this is extremely rare.

This relation of peritonitis to septicæmia compels us, before we possess a more accurate diagnostic criterion of septicæmia *intra vitam* and *post mortem*, to include both conditions in one so far as regards the cause of death. At the most we could differentiate those rare cases of peritonitis in which the inflammation does not follow the operation at once, but develops at a later period, for example, as the result of intestinal perforation or some similar complication. The majority of all cases of diffuse peritonitis are septicæmia.

When I say that a differentiation of peritonitis and septicæmia as the proximate cause of death is impossible, this also implies that it may be difficult or even impossible to recognize septicæmia in individual cases. Statistics of deaths after ovariectomy will, therefore, be more or less uncertain, and will reflect the individual views of the statistician. Among Spencer Wells's last 200 cases, more than three-quarters of which were operated antiseptically, he reports nineteen cases of septicæmia or peritonitis; only five of these cases occurred among the second hundred. Tauffer reports three deaths from septicæmia among fifty-nine cases (1880 to 1884); Karl v. Braun seventeen deaths from peritonitis or septicæmia among eighty-four ovariectomies (1879 to 1883).

Among 282 successive ovariectomies, performed antiseptically, I had eleven deaths from the same causes, but none among the last 110 operations. Nine cases were undoubtedly septic, and death occurred between the third and seventh days. In two cases there was a condition of chronic peritonitis, to which the patients succumbed thirteen and thirty-one days after the operation. Schroeder lost eight or nine cases from sepsis among 200 operations.

The results continue to improve for quite a while after the introduction of antiseptics, inasmuch as the latter is only mastered gradually by the operator and his assistants.

The course and symptoms of septicæmia after ovariectomy vary greatly. The disease generally begins on the first day. The collapse temperature, which is usually present after the operation, gives way to increased temperature more rapidly than in other cases. In the first twelve hours it does not exceed 39°, but then rises more or less rapidly to 40°, 41° or even nearly to 42°. There is usually a slight morning remission, but in some cases the temperature falls below 39° for one to two days, and then again rises. Indeed, there is not infrequently very little or no rise of temperature for days, until on the last day it reaches a height of 40° or more.

Hence, it might appear as if the course of the temperature possesses no

diagnostic importance. But the high and constantly increasing frequency of the pulse from the start, the poor subjective condition of the patient, and the peaked features, soon clear up the significance of the rise of temperature. A pulse of more than a hundred beats a minute in the first day after the operation, usually possesses this significance, unless it was present before the operation or resulted from profuse loss of blood. Septicæmia is extremely probable if the temperature is only moderately raised, while the frequency of the pulse is unusually high and constantly increases in rapidity. If the frequency of the pulse exceeds 130 to 140, a favorable termination can rarely be expected.

The peritonitis, which accompanies the septic process, generally develops in a moderately acute manner. The first symptoms are tenderness on pressure and moderate tympanites, and are generally present within twenty-four hours after the operation. The spontaneous pains are rarely very violent; the degree of tympanites varies but is rarely extreme. Notable tympanites may also remain permanently absent. But the abdomen never remains as flat as it was immediately after the operation.

Vomiting may be one of the most annoying symptoms. It increases the pains, may give rise to secondary hemorrhage from the raw surfaces, prevents the localization of the peritonitis and may even cause rupture of the abdominal wound. After the peritonitis has lasted three or four days the pains usually subside or even disappear, as they do so often in puerperal septic peritonitis. The vomiting usually continues only a few days while the tympanites lasts until the end.

In septicæmia which is not accompanied by peritonitis, or, at least, by diffuse peritonitis, the vomiting may also be very obstinate. These cases have always appeared to me to be especially grave. The patient begins to vomit on the second or third day without presenting any other evidences of peritonitis. The late occurrence of the vomiting prevents us from regarding it as an after-effect of the narcosis. All measures directed against the symptom prove useless. The temperature and still more the frequency of the pulse rise, although no local causes can be detected. After the vomiting has lasted a day, the patient is evidently collapsed and the diagnosis of septicæmia is usually undoubted. Vomiting is almost the first symptom in these cases.

The fatal end is rarely preceded by any notable disturbance of consciousness. Delirium possesses the same evil significance as in puerperal septicæmia, and I have only observed it in fatal cases. It usually remains mild, but more rarely the patients throw themselves about, try to leave the bed and no longer recognize their surroundings. One or two days before death we often notice markedly contracted pupils in such cases; this cannot be interpreted as an evidence of the action of morphine.

The fatal termination from septicæmia generally occurs on the third to seventh days, very rarely on the second day.

R. G., aged thirty-seven years. Large, uniformly fluctuating tumor; no previous puncture. During the ovariectomy almost all the fluid is discharged at the first puncture of the trocar. The mainly unilocular tumor follows the traction completely through the wound (13 cm. long). No adhesions; very little blood passed from the wound into the abdomen. Pedicle ligated in two parts with catgut. Left ovary not enlarged, and felt hidden under adhesions. The retroverted uterus is lifted up. A number of thin bands of adhesions in the retro-uterine cavity, but these do not prevent drainage of Douglas's sac with a thick rubber tube. Peg stitch. The operation strictly antiseptic. The evacuated fluid weighed twenty-seven pounds. Temperature 36.7°, pulse 60, after the operation.

Salicylic acid solution injected through tube, but fails after an hour. On drawing out the drainage tube it is found completely plugged for several centimeters by the omentum, which entered through one of the openings. During the first twenty-four hours injections were made every hour, then every two hours and after the second day every three hours. At first a little bloody fluid was found in the evacuated water, later it was clear; after the third day, purulent.

During the first twenty-four hours the temperature rose temporarily to 38.5, then fell to 37.8°. The pulse varied from sixty-eight to eighty. Vomiting three times in first twenty-four hours. Pulse 100 to 106 at beginning of second day, temperature below 38.2°: vomiting continued. Eructation and tympanites begin. Evident collapse at end of second day.

Pulse 126 on third day, temperature not above 38°, annoying nausea and vomiting, marked tympanites. Temperature not above 38° until end of fourth day, pulse 144, face dark red.

Fifth day, pulse hardly perceptible, temperature 40.7°, contracted pupils, delirium. Death at end of fifth day. Autopsy showed enormous distension of intestines, but, on the whole, free from exudation. Small amount of cloudy fluid in pelvis. Slight fibrinous deposit on uterus. Ligated pedicle healthy, spleen unchanged.

The infection had undoubtedly occurred secondarily through the drainage tube as the operation was strictly antiseptic. It is unnecessary to say that it was a mistake to employ drainage in this case.

The prognosis is based chiefly on the character of the pulse, though we may be led astray by individual peculiarities. Hence we should always study the character of the pulse by repeated examinations before the operation. The greater the difference between the pulse and temperature, the poorer is the prognosis.

Repeated vomiting, unless it occurs in the first twelve hours and is the result of the narcosis, is always of evil import. If it continues a day or more, the prognosis is almost always bad. This is also true of singultus, though slight degrees are sometimes seen in cases which recover. Early tympanites with or without peritonitic pains is a fatal sign. Moist tongue and warm perspiration are observed so often in advanced septicæmia that these signs are almost valueless. Dark red cheeks with cold extremities, delirium and very narrow pupils indicate approaching dissolution.

The statement that septicæmia and peritonitis cannot be well separated as causes of death, is only true of the diffuse acute peritonitis which generally accompanies septicæmia. It cannot be denied, however, that

peritonitis may prove fatal without being followed by primary septicæmia. A localized inflammation may develop in any part of the peritoneal cavity; the exudation may be encapsulated by adhesion of the intestines, and it may thus be made more or less innocuous. The peritoneum surrounding the focus becomes thickened, and is thus less adapted for absorption. But if the pus undergoes ichorous degeneration, even the scanty absorption may give rise to fever which gradually exhausts the patients and proves fatal from marasmus. Death often occurs at an earlier period from other causes. Thrombi may form in the adjacent venous trunks. They break down and give rise to pyæmia or embolism of the pulmonary artery. In other cases the pus ruptures into the peritoneum and causes diffuse peritonitis, which proves fatal by absorption of ichor, *i.e.*, by septicæmia.

There are various starting-points for these circumscribed inflammations after ovariectomy. They are situated most frequently in the pelvis. The fluids, blood and cyst contents, which have entered the abdomen during the operation, accumulate in the lowest part of the peritoneal sac, and encapsulation of the fluid may occur, unless fatal absorption of septic matter takes place at once. The floor and lateral walls of the abscess are then formed by the floor of the pelvis, the walls of the uterus and rectum, and the broad ligaments, while the omentum and intestines separate the abscess from the peritoneal cavity superiorly. Next in order of frequency as starting-points of abscesses are the regions in which extensive adhesions have been divided; furthermore, the pedicle and finally the abdominal wound. The dimensions of the abscesses vary as greatly as their position.

As a matter of course they develop with fever and more or less distinct peritonitic symptoms. The fever generally begins within a few days after the operation, more rarely in the second week. But the symptoms of collapse and vomiting, at least constant vomiting, which are found in septic peritonitis, are generally absent. The fever may continue a long time, and then assume the hectic type, until the exudation ruptures in a favorable direction and the patient recovers. When the peritoneum is perforated, death rapidly follows.

The majority of cases run a favorable course. Among fifteen consecutive successful operations Hegar observed three abscesses of this kind which ruptured into the intestines or through the abdominal wound.

Among 120 ovariectomies Koeberlé saw nine cases of intra-peritoneal abscesses. All recovered with the exception of one, in which the abscess was situated in the vesico-uterine fossa and perforated into the peritoneum. Three abscesses opened into the vagina, one into the intestine. An abscess in the iliac fossa and several situated behind the abdominal wall were opened with the knife, one opened through the abdominal cicatrix.

In some cases, however, death occurs from perforation into the peritoneal cavity or from chronic septicæmia, associated with a low fever dependent on absorption from the abscess. In such cases death usually occurs at the end of weeks or even months after the operation.

Active surgical treatment may undoubtedly prevent the fatal termination in such cases. In a large number of cases, Keith, Peaslee, Kimball and Koeberlé have endeavored to find the abscess, when symptoms indicative of a septic process have appeared, opened it and often drained it for weeks. If the abscess is encapsulated in the recto-uterine fossa, it may be felt through the vagina as a resistant or fluctuating tumor and opened in that region. In other cases encapsulated exudations can be detected behind the abdominal walls and opened there. If they are situated, as generally happens, near or immediately behind the abdominal wound, it is best to reopen this in part and to secure complete evacuation by means of drainage. Peaslee speaks of washing out the abdominal cavity in such cases, but this phrase is misapplied in the majority of cases. As a rule, only a small closed portion of the peritoneal cavity is opened.

The following cases may serve as illustrations:

Keith, case 52. Dermoid cyst, extensive adhesions, reopening of abdominal wound on fourth day, washing out of purulent fluid, death on sixth day.

A tumor, existing for two years, was punctured in May, 1866, but only a few clumps of fat removed. Second puncture, nine months later, discharged thirty-five pounds of thick fatty contents with hairs. Extirpation soon afterwards. Tumor adherent to entire pelvis, and must be separated from uterus, bladder, floor and walls of pelvis and iliac vessels. No organ injured, pedicle fastened externally.

Pulse soon rose to 120 and on fourth day to 140. Skin hot and dry, abdomen flat. No tumor discovered per vaginam. But Keith, believing that exudation was present, reopened the lower part of abdominal wound, divided the adhesions found there, and passed an elastic catheter along the pedicle. It filled with bloody purulent fluid. The opening was dilated and the finger inserted; vesico-uterine fossa found empty. Injections into the open wound and discharge of ten ounces of dark red fluid. After temporary improvement patient died on sixth day. Autopsy showed that walls of abscess cavity had healthy appearance. A second, closed abscess was found at a locality in which a broad adhesion had been divided with the knife. No other sign of peritonitis. Only an ounce of bloody serum in Douglas's sac.

Keith, case 53. Double ovariectomy, absence of one pedicle, clamp applied to cyst wall; pedicle of second ovary stitched in wound; fever, three punctures, recovery.

The main tumor, situated in broad ligament, was placed in clamps and filled almost entire abdominal wound. Pedicle of second ovary ligated and fastened outside. Respirations thirty to thirty-six, but patient felt well until occurrence of fever, diarrhoea and abdominal pain on the fifth or sixth day. Abscesses in different parts of pelvis evacuated through trocar on twelfth, fourteenth and twenty-first days. The patient then recovered and was discharged on forty-third day.

Peaslee extirpated an ovarian tumor, having previously removed 106 pounds ascitic fluid. Fearing the continuation of the ascites he passed an elastic catheter

into Douglas's sac through an opening in posterior fornix, and closed it with a plug. Sixth day, sudden symptoms of septic infection. On removal of plug, discharge of small amount of putrid fluid. Injections of salt solution through the catheter three times a day for a week. Patient then recovered rapidly after removal of the catheter.

In another similar case Peaslee continued the injections fifty-nine days.

That the symptoms of septicæmia were produced, not by the ascitic fluid, as Peaslee believed, but by the introduction of infectious substances through the drainage tube, will not be doubted by any one. But the cases are interesting because they were the first which were treated on the correct principle that when products of decomposition are present in the peritoneal cavity they must be evacuated, although the bold surgeon was unaware that, in these cases, he himself had produced the danger.

In a third case, the danger arose from a collection of blood, derived from the vessels of the divided omentum. Peaslee made 135 injections in seventy-eight days. The patient recovered. Peaslee states that four weeks elapsed in the second case and three weeks in the third case before the putrid character of the secretion disappeared. Each injection, however, was almost always followed by rapid temporary improvement.

Spencer Wells extirpated a tumor, situated on the lateral extremity of the otherwise normal ovary, together with the latter. Adhesions to the omentum and iliac fossa were divided with the hand, an adhesion to the bladder carefully dissected off. Pedicle ligated and replaced. On the ninth day, distended abdomen, severe pain, dry tongue. Vaginal examination showed accumulation of fluid behind uterus; five ounces of bloody, putrid serum evacuated by puncture. Temporary relief but general condition worse next day. Second puncture discharged ten ounces very foetid fluid. A drainage tube was then introduced, but removed in a few days. Patient rapidly recovered. Wells adopted similar treatment in a series of cases. In one case he regretted that puncture had not been performed, because the autopsy showed a bloody accumulation in Douglas's sac.

In a case of evident pyæmia Freund punctured Douglas's sac on the third day and evacuated eight ounces of stinking ichor. A drainage tube could not be introduced but the patient recovered.

Since the general introduction of antiseptics, cases of acute septicæmia as well as circumscribed peritonitis and abscess have become very much rarer. Nevertheless, the recent literature contains some cases.

Tirifahy opened the abdomen from above, in a case of peritonitis, and washed it with a solution of carbolic acid. The patient recovered. Similar treatment was employed successfully by Pouchon on the sixth day after the operation. Ward's patient suffered from fever (103.6° F.) on the fourth day. After removing several sutures in the abdominal wound Ward passed his finger through the adherent loops of intestines behind the uterus, where one and one half ounces decomposed fluid were found and evacuated; drainage with glass tube; attack of fever. On eighty-third day two sutures of pedicle evacuated. In Rosenberger's case fever developed on the fifth day; patient rapidly became apathetic and unconscious. Lower angle of wound opened and index finger passed to pedicle; patient then turned on her abdomen but nothing escaped. Death on same day. An abscess, containing thirty grm., was found around the other healthy ovary.

Czerny reports a case in which collapse and diffuse peritonitis occurred on fourteenth day while lifting patient. Czerny made an incision in both lumbar

regions, drained and washed with solution of thymol. The patient, who was almost moribund, improved visibly. Her death on the twenty-second day does not disprove the propriety of the treatment.

Nature not infrequently points out the proper method of treatment by the occurrence of spontaneous evacuation. In extra-peritoneal treatment of the pedicle this is especially apt to take place through the abdominal wound alongside the pedicle. On the fifth day after an operation in which a cyst had ruptured and the ligated pedicle had been replaced, Menzel observed the escape of a large amount of sero-bloody fluid from the lower angle of the closed abdominal wound. The fluid gradually became more purulent. The lower angle of the wound was opened and drainage tubes inserted; no improvement. Chills with a temperature of 40° on the twenty-third and twenty-sixth days after the operation. Permanent removal of the drain on the sixty-second day. Recovery. In such cases Koeberlé has repeatedly introduced a sponge into the abdomen along the pedicle or removed the secretion by means of aspiration.

From the reported cases we may learn the lesson that when a patient is attacked with fever, without having had primary septicæmia in the first few days or the symptoms of diffuse peritonitis, we should carefully look for encapsulated exudations, and, if they are recognized, should give them free vent when serious symptoms make their appearance.

Spencer Wells may be right in saying that the danger of puncture for the removal of such an abscess has been exaggerated. On the other hand it seems to me that the good effects have also been exaggerated. If a retro-uterine accumulation can be diagnosed with certainty and operated upon, it is encapsulated and the danger of fatal septicæmia is, in general, not very great, although the symptoms are often threatening. Experience also teaches that numberless cases of this kind recover after spontaneous evacuation and hence it is questionable, in the majority of cases, whether the incision has saved the life of the patient. Nevertheless, its justification in appropriate cases must be recognized by every one. On the whole we agree with Kaltenbach that secondary drainage is never useful in diffuse processes, and that, in the large majority of cases, the patient could not have been saved by reopening the abdomen.

Individual symptoms, particularly constant vomiting and meteorism, may demand special treatment. We have previously described the best treatment for vomiting, but it must also be mentioned that Koeberlé has repeatedly employed the stomach pump with success in such cases and also injections of water.

Meteorism may also require direct treatment. Enemata with ethereal infusions, ethereal oils internally, the introduction of wide elastic tubes as high as possible in the rectum, ice compresses to the abdomen, are the usual remedies, but they generally prove of little avail. In desperate cases the gut has been punctured with very fine canulæ.

Chadwick punctured the intestines five days after ovariectomy, but without preventing the fatal termination. Schatz employed the same plan in two cases, once with visible relief to the patient, though it did not save her; in the second case he saved the patient, but she died eight weeks after the operation as the result of dietetic errors. In this case the pedicle had been placed in the clamp, the operation performed under carbolic spray, and vaginal drainage used. On the second day the abdomen was very tympanitic; on the third day, still more distended and painful, with frequent vomiting and hiccough, marked collapse, pulse 150, respirations 36. The intestines were now punctured through the abdominal wound with the canula of a Pravaz syringe. The gases discharged $8\frac{1}{2}$ minutes in an audible current, $2\frac{1}{2}$ minutes in a feeble current. The dyspnoea subsided at once, the heart grew more quiet. But the vomiting and singultus continued, the temperature remained high, pulse 132. On the next day repetition of the puncture and discharge of gas for four and a half minutes. The patient continued to have fever for some time, but recovered. Schatz states that the autopsy showed no bad results of the puncture even in the first case. In both very thin needles were first used, but later, pointed canulæ 2 to $2\frac{1}{2}$ mm. thick.

Lange punctured the gut with a narrow trocar and discharged a vessel of thin fluid without saving the patient. The intestines still contained large amounts of fluid at the autopsy. Jenks adopted a peculiar method. He stood the patient on her head, whereupon large amounts of gas escaped.

Death from intestinal stenosis is not very rare after ovariectomy. The stenosis may occur in various ways. A loop of intestine may be incarcerated between the pedicle (which has been fastened into the abdominal wound) and some other part (abdominal wall), or an intestinal adhesion causes flexion of the corresponding loop, and thus gives rise to occlusion; or finally, torsion of the axis of the gut occurs as the result of displacement during the operation. Billroth regards the latter cause as the most frequent, but the literature of the subject does not testify in favor of this opinion. In the majority of cases a loop of intestine was adherent to the wound of the stump of the pedicle. The first-mentioned cause, *viz.*, incarceration between the pedicle and abdominal wall, will naturally disappear entirely with the abandonment of clamp treatment. Modifications of these causes have also been observed. Thus, Schinzinger reports torsion of the axis from shortening and retraction of the mesentery. I have observed intestinal occlusion by the displaced omentum, which had assumed a band shape. In adhesions of the intestine to the pedicle, which it was not necessary to divide, flexion and occlusion may undoubtedly be produced, when the pedicle has united to the wound, *i.e.*, when it has been displaced, and the adherent intestines have been com-

pelled to follow it. I have recognized the possibility of this danger in several cases of adhesion of the intestine to the pedicle, but no cases of this kind have been reported. Nor can we deny the possibility of occlusion of the gut by the tube in vaginal drainage. Finally, incarceration in the abdominal wound might occur if, while tying the deep sutures, the position of the loops of intestines is not controlled by the inserted finger. Spencer Wells even mentions a case in which a loop of intestine was included in one of the abdominal sutures, and thus compressed.

Intestinal occlusion may also occur long after ovariectomy. A. Martin mentions a case in which death occurred nine months after the operation. One of my patients died of volvulus a year after the operation. Hofmeier had the same experience. The cancerous tumor had been separated with difficulty from the wall of the bladder, and the intestine had become adherent in this situation. Shively reports a case in which occlusion occurred six years after ovariectomy. A loop of the small intestine had become adherent to the lower angle of the cicatrix in the abdominal walls. Between this loop and the abdominal walls another loop of intestine had slipped through twice and become constricted.

The frequency of intestinal occlusion is ascertained with difficulty. The most reliable data are furnished probably by Spencer Wells's tables, according to which among 1000 operations eleven patients died of intestinal occlusion from the second day to the third month after the operation. In twelve cases death occurred eight times between the second and sixth days; in one case in the second week, in two cases in the third week, in two cases in the fourth week, in one case in the fifth week, and in one case in the third month after the operation. Six of Spencer Wells's cases occurred after extra-peritoneal treatment of the pedicle; in the others the pedicle had been replaced.

In Koeberlé's cases and one of Spencer Wells's cases, no adhesions were present: in two of my cases only parietal adhesions; in one of mine and three of Wells's cases, parietal and omental adhesions; in Wells's fifth case, very extensive adhesions.

The symptoms are the usual ones of intestinal occlusion. Constant vomiting and meteorism are the most frequent; the patients finally die with symptoms of collapse. The diagnosis is by no means easy, especially if the occlusion occurs in the first few days after the operation, because a diffuse peritonitis may produce exactly similar symptoms. Even at the autopsy it may remain doubtful whether intestinal occlusion or septic infection with peritonitis has produced the symptoms and caused the fatal termination.

The following cases will illustrate the mode of development and the difficulty of diagnosis:

Spencer Wells, case 205. The pedicle (1 cm. thick, 5 to 8 cm. long) of the

right ovary was first cauterized, then ligated in two halves and replaced; the ligatures were cut off short. Operation very clean, toilette unnecessary. Nausea from the start; on the second and third days, vomiting of dark green and coffee colored masses; marked tympanites. Temporary improvement after a profuse, thin evacuation from the bowels. On seventh day, pulse 160, patient appeared moribund. Improvement after cessation of vomiting and diminution of frequency of pulse. On nineteenth day, felt very well, when syncope occurred after a profuse evacuation. Death on following day. The autopsy showed that an empty loop of intestine, which was in close proximity to the cœcum, surrounded the pedicle and was adherent to it. A small quantity of pus between the loop of intestine and the pedicle. Only traces of inflammation in other parts of peritoneum, intestines markedly distended above the occlusion.

In his seventeenth operation Wells fastened the omentum, which had been adherent, into the upper angle of the wound, and fixed the ligated pedicle of the left-sided tumor with a needle in the middle of the wound. Patient died, after vomiting of green masses and distension of abdomen. Wells had removed the needle from the pedicle because he suspected a connection between the symptoms and the fixation of the pedicle. Autopsy showed incarceration of a loop of small intestine in the space bounded by the fundus uteri, pedicle and abdominal wall; large amount of peritonitic exudation present.

In Köberlé's case a loop of intestine adhered to the pedicle and thus flexed the gut until it became impermeable.

Leopold reports a fatal case of intestinal occlusion seven days after bilateral ovariectomy. A loop of large intestine was situated transversely in the pelvis in such a way that it adhered to the stumps of both pedicles, and was impermeable in both situations. Schroeder also mentions a case in which the rectum was made impermeable by adhesion to the stump of the pedicle. In Doran's case the ovarian tumor had suppurated and adhered intimately to the gut. The autopsy showed torsion of the ilium; a large perforating ulcer of the intestine was found 25 cm. above the stenosed portion.

In my third ovariectomy there were extensive parietal adhesions and a very firm omental adhesion; separation attended with not inconsiderable hemorrhage. On account of persistent parenchymatous hemorrhage omentum allowed to remain on abdominal walls without receiving a ligature *en masse*, and is replaced in a swollen condition five hours later. Pedicle ligated in parts and replaced; no antiseptics. Frequent pulse (132) and high temperature (39.6°) on first day. On fourth day temperature from 38.2° to 38.6°, pulse 104. On fifth day uncontrollable vomiting and death on sixth day, with temperature 40.6°. Autopsy showed small, encapsulated abscess behind upper part of abdominal wound. Some sero-sanguinolent fluid, small clot and slight amount of pus in recto-uterine fossa, which was shut off from rest of peritoneal cavity. Numerous other adhesions of intestines but no masses of exudation. The colon, which was firmly clasped by the omentum, was markedly stenosed. Omentum adherent to colon and right half of abdominal wall. One part of colon adherent to origin of mesocolon; its lumen to this point distended with gas, beyond it hardly as thick as the finger. The loops of jejunum below the colon notably distended.

The patient had evidently had an attack of diffuse peritonitis and was improving when incarceration occurred. We are unable to say whether this was due chiefly to the grasping of the colon by the omentum or to the adhesion of the gut to the mesocolon.

The cause of death, intestinal occlusion or septicæmia, was more doubtful in

following case: Mrs. H., quite large, friable tumor; broad-based insertion in right broad ligament; ligature of base in two parts. Small portion of a papillary cyst left behind. About a dozen small, papillary formations felt in Douglas's sac; vaginal drainage. Vomiting on first day; second and third days, temperature 39.3°; meteorism, tenderness, eructations. On evening of fourth day, temperature 41.7°; death on fifth day. Autopsy showed entire small intestines enormously distended, the large intestine below the ascending colon only as thick as the thumb. The mesentery (filled with enormous masses of fat) of another loop of intestine passes transversely across the cœcum. Very little exudation upon the intestines above; the loop of intestines near the pelvis adherent to one another. Half a cupful of dirty fluid around the pedicle. About one to two drachms of fresh blood upon the papillomata of the retained portion of the cyst wall.

The impression created by the autopsy was that of an intestinal occlusion, dependent on a very rare cause. The fatty masses in the mesentery were remarkably large, and compression of the intestines by their weight did not appear improbable to the observer. It must be admitted, however, that the rise of temperature from the first day and the presence of peritonitis also made septicæmia not improbable. Similar doubts have arisen in other cases.

In my third case the symptoms of intestinal occlusion began on the fifteenth day after extirpation of a proliferating cystoma, weighing 20 kilo, which had presented only a few parietal adhesions. The severity of the symptoms increased so rapidly that a second laparotomy was performed on the twenty-first day. I searched at once for the stump of the pedicle, which had been ligated with rubber and dusted with iodoform. Loops of small intestine were firmly adherent to the raw surface, and stenosis of the gut resulted here from flexion. After division of the adhesions the abdomen was closed. Flatus was passed six hours later, and a copious evacuation was passed spontaneously at the end of sixteen hours.

Hegar operated successfully in two cases of ileus after ovariectomy; in one case the effect was merely temporary, as the patient died ten days later from pyæmia due to other causes.

The chief point in the operation for ileus is not to delay too long, or the intestinal paralysis will persist, and the collapsed patient will not recover. It would be expected that ileus occurring after ovariectomy offers especially favorable chances for surgical treatment, because it is probable that the pedicle is implicated in the production of the stenosis, and the operator, therefore, knows from the start the locality in which the stenosis is to be looked for. Very little experience, however, seems to have been obtained concerning this condition.

It may also be mentioned that intestinal occlusion sometimes terminates in the formation of a fistula. The majority of such cases occur in individuals who had long recovered from the operation, and will, therefore, be discussed among the sequelæ.

The formation of circumscribed foci of pus or ichor in the abdomen, sometimes gives rise to the development of extensive thrombi in the

vicinity, and the degeneration of the thrombi may produce pyæmia or embolism. Cases of this kind have been often observed, and may terminate either favorably or unfavorably.

Saltzmann observed the sudden development of aphasia seven days after an ovariectomy in which the pedicle had been cauterized and replaced. He attributed it to embolism of the middle cerebral artery secondary to thrombosis of the pelvic veins.

Schwartz observed fatal embolism complicating peritonitis. Thiersch reports an interesting case. The patient had three attacks of pneumonia, nine days, six weeks and five months respectively after the operation, and also an inflammation of the kidneys, all evidently the result of embolic processes. The patient recovered.

Billroth reported a case, which was probably one of embolism of the superior mesenteric artery. At the end of the first week after the operation febrile movement began. Grave collapse, the result of a profuse intestinal hemorrhage, then developed suddenly. The patient long hovered between life and death, but finally recovered.

Among the 127 fatal cases in his first 500 ovariectomies Spencer Wells had two deaths from pulmonary embolism. One of the two cases observed by me is reported on page 253.

The primary factor in all these cases is an inflammatory process in the pelvis. This gives rise to thrombosis of the pelvic veins or one of the veins of the thigh. The efficient factors are in part the compression of a main trunk, in part the vicinity of the abscess and the absorption of its constituents. The abnormal products of putrid decomposition, circulating in the blood, furnish the cause for subsequent degeneration of the thrombus and for embolism. In this way alone can we explain the fact that degeneration of thrombi occurs so much more frequently in pyrexial conditions (especially septic fever) than in the absence of fever. However, fatal pulmonary embolism, secondary to pure compression-thrombi of the veins of the thigh or pelvis, also occurs occasionally despite the entire absence of fever. This also occurs in cases of ovarian tumor, in which an operation has not been performed, although it is much rarer than in uterine myomata and after myomectomies. Treatment of such conditions is hardly to be thought of. As a matter of course, the collapse is to be combatted with stimulants, if the embolic seizure does not prove fatal forthwith.

Tetanus occurs with comparative frequency after ovariectomy. I have collected the known cases in three groups: I. those occurring after clamp treatment; II. those in which the pedicle was secured extra-peritoneally by perforating needles, wire constrictors or other metallic instruments; III. those in which the pedicle was merely ligated and replaced.

I. CLAMP CASES.

	Operator and Source.	Operation. Treatment of Pedicle.	First and last day of operation.	Remarks.
1	Nelaton, Gaz. hebd., 1862, p. 401 and 483.	Clamp; removed on 4th day.	2-21	No peritonitis.
2	Howitz, Virch. and Hirsch. Jbber., 1875, II. p. 570.	Many adhesions. Clamp.	7-10	No other disease
3	Mensel, Corres. Bl. d. allg. Thü- ring-ärztl. Ver. 1876, II.	Unilocular cyst without adhesions. Clamp, re- moved on 12th day.	17-21	No peritonitis. Gritting of teeth and spasms in the arms on the night of the day of opera- tion.
4	Kaltenbach. Personal com- munication.	Small unilocular tumor without adhesions. Clamp; slender pedi- cle.	16-24	No fever after 4th day; in last few days rise of temperature to 42.7.
5	Kaltenbach, Personal com- munication.	Papillary cystoma. Pa- rietal adhesions. Thick pedicle. Clamp.	7-8	Apyrexia after 4th day.
6	Schroeder, Stz. br. d. Phys.- Med. Soc. zu Erlangen. May 10th, 1873.	Extensive parietal ad- hesions. Clamp.	9-12	No peritonitis
7	Schroeder, <i>Ibid.</i>	Firm parietal adhe- sions. Clamp.	2-15	Slight fever in first few days. Traces of peri- tonitis.
8	Spencer Wells, Diseases of the Ovaries, Case 9.	Large multilocular cyst. Clamp, removed on 3d day. Abdominal su- ture with hare-lip needles.	4-6 relapse 15th day recov'ry in 2 w'ks	Treatment with curare, gr. $\frac{1}{15}$ - $\frac{1}{8}$ on blister wounds and on pedi- cle.
9	Spencer Wells, <i>Ibid.</i> Case 12.	Large multilocular cyst, short pedicle. Clamp, removed before 7th day.	7-10	Asafoetida, chloroform inhalations. Curare, gr. $\frac{1}{8}$ on 10th day.
10	Spencer Wells, <i>Ibid.</i> Case 35.	Omental and intestinal adhesions. Omentum fixed in wound with 2 needles. Clamp re- moved on 3d day.	12-14	Prominent remains of pedicle and omentum removed on outbreak of trismus. Trache- otomy. Chloroform inhalations.
11	Stilling, Die Ex- tra-peritoneale Methode, p. 174.	Few adhesions; short pedicle. Clamp.	9-12	Uterus had suffered trac- tion. Pneumonia.

I. CLAMP CASES.—*Continued.*

	Operator and Source.	Operation. Treatment of Pedicle.	First and last day of operation.	Remarks.
12 {	Stilling, Deutsch Klin. 1867, No. 11, Case 11.	Omental and intestinal adhesions. Part of tu- mor grasped by clamp. Pedicle also ligatured en masse and fixed to abdominal walls with lancet-tipped needle; latter removed on 11th day.	13-22	Two secondary hemor- rhages, from pedicle. Firm application of clamp. Needle caused severe pain. Curare toward close of life.
13 {	Stilling, Deutsch Klin. 1872, No. 45, Case 27.	Large tumor. Clamp applied to pedicle; hemorrhage. Then pedicle ligated and re- placed.		Violent fright on 6th day. Beginning of spasm soon after.
14 { & 15 {	Uhde, Deutsch Med. Wschr. 1880, No. 5.	In one case, pedicle fixed by needle in ad- dition to clamp.	?-12 ?-4	
16 {	Boye, Gyn. of Obst. Meddel. II. 1. 1878.	Clamp treatment. Sim- ple cyst. Long pedicle.	?-9	
17 {	Parvin, Tr. Amer. Gyn. Soc. II. 1877, p. 320.	Tumor weighing 40 lbs. Long pedicle.	5-6	Opium, morphine, chloroform.
18 {	Kimball (1877), referred to by Parvin.	Intestinal adhesions.	3-5	
19 {	Tilanus, verbal communica- tion.	Clamp treatment.	14	Recovery.
20 {	Briesky, verbal communica- tion.	Parovarian cyst. Clamp and wire constrictor.	†	

II. EXTRA-PERITONEAL TREATMENT OF PEDICLE BY ACUPUNCTURE,
CONSTRICTORS OR STITCHING.

	Operator and Source.	Operation. Treatment of Pedicle.	First and last day of disease.	Remarks.
1 {	Sarrel, verbal communica- tion.	Acupuncture of pedicle.	†	
2 {	Stilling, Deutsch. Klin. 1867, No. 22. Case 12.	2 pedicles; both ligated. Constrictor and lancet needle to main pedicle. Former removed on 5th day, latter on 6th day.	9-10	Repeated hemorrhage from pedicle. Ice com- press; liq. ferri ses- quichl. Double pneu- monia.

II. EXTRA-PERITONEAL TREATMENT, ETC.—*Continued.*

	Operator and Source.	Operation. Treatment of Pedicle.	First and last day of disease.	Remarks.
3	Stilling, Deutsch. Klin. 1868, No. 20.	Sarcoma, ascites, firm thick pedicle. Wire constrictor removed on 3d day.	8-9	Peritonitis on 3d day. Stinking pedicle, ichor- ous peritonitis. Stump cut sharply.
4	Stilling, Deutsch. Klin. 1869, No. 26.	Double ovariectomy. Both pedicles cauter- ized, then wire liga- tures and lance nee- dles. Constrictors re- moved 5th and 7th days, needles on 9th day.	7-9	Secondary hemorrhage from one pedicle. On 8th day 0.05 curare; 9th day 0.04 every 3 hours.
5	Rose, Pitha-Bill- roth's Chirurgie, p. 51.	Pedicle perforated with needle. Daily increas- ed constriction of ped- icle.	† before the 14th day.	
6	Bach, Gaz. Méd. de Strasb. 1852, p. 424.	Fibroma, weighing 16 lbs.; ascites. Pedicle ligated. Remnant of tumor stitched into wound. Method not mentioned.	12-15	
7	Kimball, Bost. Med. & Surg. Journ. 1874, No. 22.	Pedicle and omentum secured in abdominal wound without clamp.	11-20	No peritonitis.

III. INTRA-PERITONEAL TREATMENT OF PEDICLE.

	Operator and Source.	Operation. Treatment of Pedicle.	First and last day of operation.	Remarks.
1	Stilling, Deutsch. Klin. 1872, No. 42. Case 25.	Pedicle ligated with 4 hemp ligatures and replaced.	5-6	Apparently septic peri- tonitis.
2	Zweifel, Berl. Klin. Wschr. 1881, No. 22.	Pedicle ligated in 2 halves with silk and replaced.	6-7	Autopsy; slight signs of peritonitis.
3	Zweifel, ibidem.	Pedicle treated as in No. 2.	10-13	Morphine, and in 2 days, 0.142 curare.
4	Boye, Gyn. of Obstet. Med. del. II. 1, 1878.	Catgut ligature.	7-15	
5	Spencer Wells. Ovarian tu- mors. Table, No. 898.	Ligature.	7-7	

III.—INTRA-PERITONEAL TREATMENT, ETC.—*Continued.*

	Operator and Source.	Operation. Treatment of Pedicle.	First and last day of operation.	Remarks.
6 {	Bennet, Virch. & Hirsch Jhr. ber. 1881, II. p. 536.	Pedicle ligated, cauter- ized and replaced.	16-18	
7 {	Gregory, Par- vin's tables.	Ligature.	3-5	
8 {	Bantock, Doran in Trans. Path. Soc., 1880.	Twisted pedicle. Sim- ple ligature.	7-8	
9 {	Baum, verbal communication.	Silk ligature.	†	
10 {	Author.	Clean operation. Ped- icle constricted with wire and ligated with catgut.	11-13	
11 {	Author.	Torsion of pedicle. Un- clean operation. Ped- icle treated as in No. 10.	17-19	Abscess, as large as a walnut, at the pedicle.

Various other cases have been reported, but as no details were given, I have omitted them from the tables. Thus, two fatal cases are mentioned by Gaillard Thomas and one by Malius, and in Bigelow's table it is said that Kimball observed tetanus five times in 267 ovariectomies. Bixley lost a patient twenty days after the operation. Boinet saw tetanus develop on the eighth day, and Murray Humphrey lost a patient on the twelfth day. Finally, Péan also reported a case. All these cases terminated fatally.

A single case of chronic, non-fatal tetanus is mentioned in the Amer. Journ. of Obst., July, 1879, p. 598. It appeared between the tenth and fifteenth days; treatment consisted of morphine injections, chloral enema and the application of electricity.

Krassowski also states that he observed trismus twice during the operation. One patient died on the third day from internal hemorrhage, the other on the fourth day from peritonitis. These were evidently not cases of true trismus. Not including the latter, we have collected forty-nine cases, of which three alone did not terminate fatally.

The disease began twice on the third day after the operation, twice on the fifth day, several times on the seventh day, twice on the seven-teenth day, but usually in the second week. It almost always proved

fatal in two to three days. When it developed late, its duration was prolonged, even to nine days.

Recovery occurred slowly in Wells's case, which did not appear until the fifteenth day. But even in this instance the first signs of trismus appeared on the fourth day, but disappeared, and the relapse did not develop until the fifteenth day. In Mensel's case, likewise, spasmodic symptoms occurred on the day of operation, but disappeared, and the relapse developed on the seventeenth day.

Although there have been only forty-nine cases among thousands of ovariectomies, all occurred in the practice of twenty-three operators, and nine of these observed it repeatedly in a comparatively small number of operations. Spencer Wells's first three cases occurred before his thirty-sixth operation; he then saw no further case until No. 898. Kaltenbach's two cases occurred among his first five operations, Schroeder's among his first six operations, and Stilling's seven cases among twenty-nine operations. It is evident that this is not the result of chance. Stilling's bad luck could not be dependent on endemic or epidemic conditions, because his cases were remote in time and place of operation. Kaltenbach operated on his two cases at an interval of fourteen days, but not in the same hospital. With regard to Malin's case, however, it is said that three other cases of tetanus occurred within three months in the same hospital after other operations.

A priori it is probable that the accumulation of cases in the practice of a few operators was the result of the method employed by them. In examining Stilling's cases we are struck by the fact that he usually treated the pedicle in two or three ways; he generally ligated, applied the clamp or wire constrictor and also perforated it with a needle, which was allowed to remain. The latter method is expressly mentioned three times, and was also used in Rose's case and Spencer Wells's third case (through the omentum.) Needles for abdominal suture were allowed to remain in another of Spencer Wells's cases. How often the lance needles were used in the other cases cannot be ascertained, but the suspicion arises that this plan of treatment has often played a part in the development of tetanus.

Many thousand cases have been treated with the clamp without being followed by tetanus, so that not the method itself, but its mode of application must have been at fault. Stilling's cases also furnish a hint in this regard. Secondary hemorrhages, which occur very rarely after clamp treatment, are mentioned in three cases. Hence, the clamp had not been applied with sufficient firmness, and the sensibility of the nerves of the pedicle had not been abolished at once.

Kaltenbach also believes that he did not exercise sufficient compression in his two cases.

The number of cases of tetanus after replacing the pedicle has increased since intra-peritoneal treatment is adopted almost exclusively.

But in the two cases observed by me the pedicle was compressed by the wire constrictor in front of the catgut ligature, and in view of our experience of clamp treatment, it is not improbable that this gave rise to the danger. Similar procedures were perhaps adopted in the cases of Kimball and Stilling.

We may accordingly recommend the following prophylactic measures: if the clamp or wire constrictor is applied, the pedicle should at once be compressed completely, the clamp applied as firmly as possible. Lancet-tipped needles for perforation of the pedicle, omentum or abdominal walls should not be allowed to remain.

The curative treatment is the same as that of tetanus in general. In extra-peritoneal treatment of the pedicle we may feel called upon to remove compressing instruments or needles, or to perform partial excision of the end of the pedicle.

Finally, death from exhausting suppuration may occur after operations in which parts of the peritoneal cavity have been kept in permanent communication with the surface of the body from the start, or in which intra-peritoneal abscesses have subsequently opened a path for themselves, and given rise to protracted suppuration. As a matter of course, operations of the most difficult character are almost the only ones in which such a termination takes place. The pus is either derived from the cyst-walls of larger parts of the tumor, which have been left behind, or from parts of the peritoneal cavity in which ligatures remain, especially ligatures *en masse* on the pedicle, or broad adhesions in the pelvic cavity. In such cases ligatures and *débris* of necrotic tissues are not infrequently discharged from time to time through the fistulous canals. The fever usually assumes a hectic character. It is hardly at all elevated in the morning, but considerable elevation occurs after noon. Numerous variations are observed, and depend chiefly on the stasis of pus. This stasis and the unusual rise of temperature often disappear with the discharge of a shred of tissue which has blocked the escape of pus.

We are unable to foretell the duration of suppuration after a fistula into the abdominal cavity has lasted for some weeks, especially when a considerable portion of the tumor has been left behind, and has been stitched into the abdominal wall. The prognosis depends chiefly on the strength of the patient, on her ability to endure the protracted fever, the vital losses by suppuration, the loss of appetite and the insomnia due to the sweating and pains, which persist until the suppuration ceases.

The objects of treatment are to effect a passage to closed depots of pus, to prevent the retention of pus and septic infection, to maintain strength by nourishing diet, to stimulate the appetite by means of fresh air, and other suitable remedies, and finally, to rouse the patient's courage and patience. Direct antipyretics are of very little or no avail, and are to be avoided whenever they disturb digestion.

CHAPTER XLIV.

CONDITION OF THOSE WHO RECOVER AFTER OVARIOTOMY.

GENERAL CONDITION AND MENSTRUAL CONDITIONS.

RECOVERY after ovariectomy is generally complete and permanent. The majority of patients recover in a few months, so that they are healthier and stronger than for years before the operation. After the first four to six weeks there is often a rapid increase in the weight of the body. A young patient, from whom a proliferating cystoma (seventeen pounds) had been removed, and who had lost six to seven pounds in the first three weeks after the operation, gained twenty-four pounds in four and a half weeks after her discharge. Another patient weighed (with a thirty-one and a half pound tumor) 138 pounds before the operation. At the time of her discharge she weighed only 105 pounds, but increased eighteen pounds in weight in the next ten weeks. Both ovaries had been extirpated in this case. Bailly mentions that in one of Anger's cases the weight of the body increased from ninety to 240 pounds in three years; both ovaries were removed. An unusual embonpoint is also acquired after the extirpation of a single ovary, although this is denied by Spencer Wells.

The condition of menstruation after ovariectomy possesses special physiological interest. After unilateral ovariectomy in individuals who have not reached the menopause, menstruation returns sooner or later after the operation, according as the body has been more or less reduced. In the majority of cases it seems to return at the end of seven or eight weeks.

In certain cases the influence of the disease on the menstrual conditions is manifested very distinctly. Previous abnormal hemorrhages may give place to regular menstruation after the operation, or previous amenorrhœa is followed by regular menstruation. I have seen instances of both conditions. The following cases were very striking. A robust, unmarried woman, aged twenty-two years, had menstruated regularly from her fourteenth to seventeenth years, but then suffered from complete amenorrhœa for five years. A very large multilocular tumor was extirpated, and in the next four and a half months she had menstruated three times at regular intervals, while at the same time she had regained her former fullness of body. Another woman, aged thirty-one years, had not menstruated in fifteen months. A sarcoma, weighing 3150 grm. was re-

moved. A hemorrhage from the vagina occurred in the first eight days after the operation, and four weeks later a second one.

We must also refer to the fact that, after extra-peritoneal treatment, the menstrual hemorrhage may appear at the pedicle. This has been seen by numerous observers, and formerly was often regarded as a late secondary hemorrhage from the pedicle or abdominal wound. As a rule, such hemorrhages occur only at the first menstruation or the first two menstrual periods, and are inconsiderable in amount. Bryant observed hemorrhage from the pedicle lasting two days with the first four menses. Then the hemorrhage from the pedicle was not noticed during the two next menstrual periods, but reappeared at each menstruation from June, 1865, to October, 1868. Walter F. Atlee also mentions a case in which the patient menstruated from the abdominal wound for two years after the healing of the very short pedicle; a small portion of the abdominal wound had never closed.

This condition is unattended with any disturbance, and its physiological interpretation is not difficult. The hemorrhage comes from the lumen of the tube found in the pedicle. The condition also possesses a pathological interest. It has been said that hemorrhage from the tube may also occur when the pedicle is replaced, and may thus give rise to hæmatocele and pelvic peritonitis. Spencer Wells thinks that he has seen such cases, and believes that this danger is the chief objection to intra-peritoneal treatment of the pedicle. For this reason Péan, in 1880, advocated the exclusive adoption of extra-peritoneal treatment. It seems to us that neither theoretical considerations nor experience should induce us to share these fears. Intra-peritoneal hemorrhages, after replacing the pedicle and removal of the tube, are undoubtedly possible. This undoubtedly occurs quite often under normal conditions and without previous ovariectomy, because the tubal mucous membrane may exude blood as the result of the menstrual congestion. But a slight hemorrhage of this kind into the peritoneal cavity does not produce the clinical phenomena of hæmatocele, nor, in fact, any symptoms. That amputation of the tube will permit increased hemorrhage into the abdomen is an unfounded assumption, which, at the most, would only hold good for those very rare cases in which there is a stasis of menstrual blood in the tubes themselves. Although the pedicle has been replaced in thousands of ovariectomies, very few cases of this kind have been reported. Schroeder mentions a case in which the tube was not extirpated, and in which a hæmatocele developed at the next menstrual period. He also refers to a fatal case, the only one of the kind reported. Extensive adhesions, particularly in Douglas's sac, which bled profusely, were divided during the ovariectomy. Death occurred suddenly from internal hemorrhage on the nineteenth day after a favorable course.

The condition of menstruation after bilateral ovariectomy is especially

interesting. But as this question is much more important with regard to castration, it will be considered under that heading, and we will merely state here that the immediate and permanent disappearance of menstrual and other uterine hemorrhages constitutes the rule after bilateral ovariectomy.

Other physical or psychical changes do not occur, as a general thing, after bilateral ovariectomy, except that in some cases the patients grow excessively fat.

W. Atlee states that one of his patients had a shaven beard fourteen years after bilateral excision, but she had reached the age of fifty years. Peaslee says that he has seen three patients, suffering from ovarian disease, who had a distinct beard, but he was unable to follow the cases. The condition developed slowly in all, and he suspects that it generally indicates bilateral disease. I have also observed a case of this kind in a girl of twenty-two years, who had a stout, plump figure, projecting cheek bones and a masculine physiognomy. The disease had evidently lasted a long time, as shown by the amenorrhœa of six years' duration which disappeared soon after the operation. After the operation she asked for her razor, and as this was not forthcoming, a beard soon grew which would have done credit to many a young man. The ovary which was left behind appeared to be very small.

The sexual sensations are not necessarily diminished, either after the unilateral or bilateral operation. Peaslee, Bailly, Spencer Wells and Koeberlé believe that no injurious effect in this respect is observed. The sexual desire may even be increased after unilateral ovariectomy, probably on account of the restoration of more vigorous health.

Subsequent pregnancy has been observed in numerous cases after unilateral ovariectomy. Some patients have given birth to a number of children after the operation, and stress should be laid on the fact that neither pregnancy nor parturition suffer any disturbance. Hueffell's often quoted case is the only exception in this regard. In this instance parturition or the puerperal state seems to have been the starting-point for an abscess around the pedicle. Abortions have often occurred after ovariectomy, but no connection with the anatomical changes in the abdomen seems to have been demonstrable. But in one of Howitz's cases Ingersler thought it possible that two subsequent abortions were connected with the abdominal position acquired by the uterus. This had become especially marked in the first pregnancy which followed the ovariectomy. This pregnancy, however, was uninterrupted.

W. F. Atlee mentions a case in which parturition, four and one half years after ovariectomy, terminated fatally. The very short pedicle had been united to the lower angle of the abdominal wound. But the difficulty of the labor appeared to be due rather to the advanced age (thirty-seven years) of the primipara, than to the operation, although the left horn of the uterus was still firmly adherent to the abdominal cicatrix.

SEQUELÆ.

An extremely sad condition may develop after recovery as the result of the formation of an intestinal fistula. This condition sometimes follows an intestinal stenosis, whose causes and termination in ileus have been described on page 318, sometimes an abscess in the peritoneal cavity, which has led to perforation externally, and at the same time, to erosion of the walls of the intestines. It is evident that this is more apt to occur if it has been necessary to separate the adherent gut during the operation, and perhaps to deprive it here and there of its peritoneal lining. Experience teaches, however, that such predisposing factors are not always requisite.

Intestinal fistulæ are more apt to develop months after the operation than at an early period. No positive opinion can be formed concerning the frequency of the accident. It is probable, however, that it occurs much more frequently than it is reported. The following cases will illustrate the mode of development:

Lyon performed an easy operation, but the abdominal wound reopened on account of the movements of vomiting and coughing. The intestines were seen in the bottom of the wound. The abdominal wound finally closed, leaving an intestinal fistula which was still present one half year after the operation.

Keith performed a bilateral ovariectomy, and ligated and replaced one pedicle. At the end of six weeks a pelvic abscess developed, with fever and pain, and perforated above Poupart's ligament. This had almost healed, when pus again appeared, together with fecal masses. The fistula closed spontaneously fifteen months after the operation.

Bryant performed a simple operation and ligated the pedicle with whip cord. On the seventeenth day an abscess broke through the lower angle of the wound, but closed four days later. It reopened a week later, and the pus was mixed with feces; ligature material was also discharged. The wound then closed spontaneously and permanently.

Spencer Wells observed the following case: The pedicle of the left-sided tumor had been ligated in halves and replaced together with a third ligature. The ligatures were cut off short. A firmly adherent piece of the cyst wall, with a long ligature, was left in the left iliac fossa. Eight weeks after the operation the discharge increased and became somewhat feculent. Three weeks later the ligature was discharged. The secretion became scanty, but the abdominal fistula did not close, and was mixed occasionally with feces. Finally the patient took to bed, suffered from diarrhœa with profuse evacuation of intestinal contents through the abdominal fistula, and died about twenty months after the ovariectomy.

The autopsy showed: the walls of the fistula were formed by the omentum and loops of the intestines. Near the left side of the uterus lay a spongy mass, which projected towards the rectum. In its centre was a suppurating cavity, which communicated with the fistula and rectum by two large openings. The cavity extended between the rectum and uterus, to the side of the uterus, and anteriorly to the inguinal ring. Not a trace of a ligature could be found.

W. L. Atlee, after evacuation of a clinically unilocular tumor, found such firm adhesions in the pelvis that he was compelled to separate and leave behind the

"peritoneal covering of the tumor." It was ligated, cut short, and left in the recto-uterine fossa; the clamp was applied to the pedicle. When the pelvic ligature was discharged, faecal matter was also evacuated. This diminished from day to day and the abdominal wound was entirely closed in a few weeks.

In this case it is possible, in view of the firm adhesions in the pelvis, that a communication with the intestines existed before the operation. The ligature produced temporary closure, which did not remain complete after separation of the ligature, but soon became complete again.

In the formation of intestinal fistulae after ovariectomy the pressure of ligature knots or drainage tubes, which have eroded the intestinal walls, is probably a frequent cause, in the same way that the perforation of abscesses into the gut, without the formation of an external fistula, is favored by such a condition. The material of the ligature is not unimportant in this respect. Whip cord, which was used in Bryant's case, must cause erosion more readily than good silk or catgut. Of special importance is the possibility, evidenced by several cases, of spontaneous closure of the fistula. It constitutes an indication that operative interference is not to be adopted too early in such cases.

Not less grievous than the affection just described and apparently much more frequent, is another sequel after ovariectomy, *viz.*, carcinoma of some of the abdominal organs. Too little importance has been attached to this fact, to which I called attention eight years ago. The literature is full of cases in which after extirpation of an apparently benign tumor, the patient subsequently died of cancer, usually of some organ in the abdominal cavity. We will here adduce only a few illustrations:

E. Martin; woman aged thirty-two years, extirpation of ordinary proliferating cystoma, weighing eleven pounds. Pedicle stitched into abdominal wound. Recovery. Death at end of eight months. Autopsy: cancer of pancreas, both lungs and the glands in their hilus; small nodules in right kidney.

Bantock extirpated both ovaries; clamp to one pedicle, the other replaced. At end of three months cancer begins in pedicle to which clamp had been applied. Death one year after operation.

Panas found, eighteen months after ovariectomy, the following conditions: cancer of both breasts, infiltration of axillary, inguinal and lumbar glands, cancer of both clavicles, right scapula and spinal column; no cancer of genitalia. The patient was alive at time of report of case. Although not stated explicitly, it is evident from the tenor of the communication that the extirpated ovarian tumor was not cancerous.

F. Winckel extirpated, in a woman of forty-two years, a proliferating cystoma, in which the microscope showed numerous processes of fatty degeneration. The pedicle was replaced. Soon after recovery the patient was again taken sick and died four months after ovariectomy. Autopsy: cancer of liver and peritoneum, parenchymatous nephritis. Winckel suspects that the ovarian tumor contained cancerous particles, but he entertained this view on account of the appearances on autopsy. The microscope, however, had shown merely a proliferating cystoma.

E. Müller has informed me of a similar case. Six months after extirpation of a benign ovarian tumor, the patient died of cancer of the omentum. —Rich had

been stitched into the upper angle of the wound. Two cases are reported by Klebs; after incomplete extirpation of a benign tumor by Neuhaus, a vascular tumor, with the characteristics of adenoma, made its appearance, at first in the cicatrix. In the second case (Spiegelberg) a colloid cystoid had been extirpated; tumors in the pelvis and an ulcerating intestinal cancer developed subsequently.

Spencer Wells. Case 3, patient aged thirty-three years, tumor weighing twenty-one pounds, with innumerable small cysts; fifty-seven pounds ascites. Patient died at the end of ten months. Chronic peritonitis is found with countless new formations, of a cellular structure (apparently sarcoma, not carcinoma).

Spencer Wells. Case 61, patient aged sixty-one years, tumor weighing thirty-seven pounds, numerous adhesions. Small parts of tumor left upon the cæcum. Two and one half months after operation, patient taken with vomiting and abdominal pains; rapid fatal termination. All the organs in right side of abdomen found enclosed in cancerous masses; scirrhous and cyst formations in remaining ovary.

Spencer Wells. Case 63, patient aged thirty-eight years, tumor weighing forty-six and one half pounds, difficult operation; apparently ordinary, proliferating cystoma; death in three months. Entire abdominal cavity found filled with encephaloid masses.

Spencer Wells. Case 111, patient aged forty-five years; peculiar tumor, multiple cysts, weight sixteen pounds. Cancer found in abdominal cicatrix six weeks later.

Wells also reports twenty-six additional cases. Among these thirty cases were three of diffuse carcinoma, three of carcinoma uteri, two of carcinoma recti, and one each of carcinoma of the pedicle, kidneys, liver and lungs; the other cases are merely reported as cancer.

Macdonald saw two cases of cancer (sigmoid flexure and peritoneum) develop among twelve recoveries after ovariectomy.

L. Tait reports a papillary cancer of the peritoneum two years after ovariectomy in a girl of nineteen years.

M. Boettger mentions two cases. In one the cancer was discovered two and one half months, in the other five months after extirpation of an apparently benign tumor.

The age of thirty-three patients, who were attacked subsequently by cancer, is given as follows: one case nineteen years, four cases twenty to twenty-nine years, thirteen cases thirty to thirty-nine years, seven cases forty to forty-nine years, five cases fifty to fifty-nine years, three cases sixty to sixty-eight years.

In thirty-eight cases the cancer developed eleven times within three to six months after the operation, ten times within six to twelve months, eleven times within the second year, five times within three to six years, and once at the end of seven years.

In the majority of cases the cancer was situated in the abdominal cavity, intestines, omentum, etc. In three cases the uterus is mentioned as the seat of disease, in others the lungs, liver, kidney, pancreas, mammae, spine or other bones.

Only two alternatives are possible with regard to the causation of this striking phenomenon. Either the tumor, although it appeared to be a

proliferating cystoma, was really a mixed form, *i.e.*, it contained carcinomatous parts; or the ovarian tumor was an ordinary myxoid cystoma, but its extirpation resulted in the subsequent carcinoma by retention of epithelial cells from the adenoma, or by the escape of such cells into the abdominal cavity. These epithelial elements took root, were nourished and developed into carcinoma.

There can be no doubt that mixed tumors of the ovary are frequent, and that certain cystomata contain parts of a decidedly carcinomatous structure, which can not always be discovered, even with the aid of the microscope. It is probable, therefore, that many of the reported cases were instances of malignant ovarian tumors, but it is questionable whether this is true of all cases. It is possible that a tumor, which presents the characteristics of a cystoma or adenoma throughout, may give rise to secondary tumors in the abdominal cavity with the microscopic and clinical characters of true carcinoma. If this assumption should prove true, it would form the beginning of our knowledge of the conditions under which epithelial cells develop into carcinoma. At the same time it would offer a new support for the doctrine of the purely epithelial genesis of carcinoma, or rather it would vitiate one of the arguments against this hypothesis. The apparently primary character of carcinoma in places devoid of epithelial cells, such as the bones and serous cavities, has always been the main objection to the epithelial theory, and the opposing view that in such cases the true primary carcinoma has escaped observation, has not been proven. With regard to cancer found in the abdominal cavity of females, we would have to think of the possibility of its origin from the surface of the ovary. If epithelial cells on the surface of the peritoneum may develop into carcinoma under certain conditions, the possibility is not excluded, even in the absence of an ovarian cystoma, that cells of the germinal epithelium of the ovary may form the starting-point for such cancers.

For the present it can merely be said that carcinoma of the abdominal cavity develops not very rarely after ovariectomy. The frequency of this sequel and its explanation, must be left to further observation. The hypothesis advanced above is supported materially by the possibility discussed on page 251, that portions of tissue in the peritoneal cavity may be nourished by diffusion for a considerable period. Without the facts there adduced, we would hardly venture upon the above-mentioned hypothesis concerning the development of carcinoma, or would be compelled to assume that the tumor was incompletely extirpated in every case of this kind.

RELAPSES AFTER OVARIOTOMY.—REPETITION OF THE OPERATION.

An ovarian tumor returns occasionally after its extirpation. Either the second ovary is diseased after extirpation of the other, or after incom-

plete extirpation of a tumor the remainder continues to grow—a relapse of the old tumor in the strict sense of the word. Both events are not very frequent.

The literature contains only a comparatively small number of cases of subsequent disease of the second ovary after extirpation of the first. Single cases have been reported by Bird, Boinet, Caswell, Keith, Potter, Schatz, Tenier, Carter and Kimball. Drysdale and W. L. Atlee report four cases, Spencer Wells thirteen cases; I observed two cases. My cases were as follows: 1. A girl aged twenty-four years; in August, 1878, I removed a very brittle, parvilocular tumor, weighing 5 kilo, from one ovary. The other ovary was perfectly healthy. At the end of two years and two months I again performed ovariectomy upon the patient, who had married in the meantime. The tumor of the second ovary was also parvilocular and very brittle. It weighed 4 kilo. 2. Patient aged forty-two years. In May, 1882, I removed a very large, proliferating cystoma of the right ovary; the left ovary was found to be healthy. At the end of a year the abdomen was again enlarged, and one and three-quarter years after the first ovariectomy I removed another proliferating cystoma weighing 3 to 4 kilo. Both patients recovered from the second operation.

Spencer Wells operated twice in thirteen cases; eleven of these occurred among his own 1000 cases, two in the practice of other operators. This small proportion is so much more noteworthy, because in former times the second ovary was not always examined during ovariectomy. The period which elapsed between the first and second operations varied, in different cases, from six months to twenty-five years. In twenty-six cases, concerning which precise statements are made, the interval in two cases was not more than one year, in four cases not more than two years, in seven cases two to five years, in seven cases five to ten years, in three cases ten to fifteen years, in two cases fifteen to twenty years, in one case twenty-five years.

Although the reports on disease of the second ovary after previous ovariectomy are very incomplete, it is probable that the percentage of cases is very low. This is so much more striking when it is borne in mind that coincident disease of both ovaries is by no means infrequent, and necessitates double ovariectomy in 16 per cent. of all the cases. Malignant tumors and papillary cystomata are bilateral in the large majority of cases. It may, therefore, be claimed that ovarian tumors, if they develop on both sides, do so from the start.

True relapses, starting from the pedicle of the extirpated ovary, are much less frequent. The first case seems to have been reported by Weinlechner. Double ovariectomy was performed on the patient in April, 1867. Menstruation, which had appeared only three times before the operation, then became regular, and the formation of a tumor on the abdominal walls was not noticed until seven years later. Weinlechner re-

moved it after it had attained the size of a man's head, nine years after the first operation. It appeared to have started from the pedicle of the left-sided tumor, which had been stitched to the abdominal wall.

I have seen two undoubted cases of relapse after ovariectomy, but must state that in both cases the portion of the tumor which had been left behind was about as large as a fist.

The first case (October, 1881) occurred in a woman aged sixty-four years, with a bilateral subserous tumor, whose peculiarities consisted of the loose connection of the cysts, their great delicacy, and the thin watery contents.

The second case was one of proliferating, non-papillary, but entirely subserous cystoma of the left ovary, which I extirpated in September, 1883, from a woman aged forty-two years. The enucleation was so difficult, and the base of the tumor was seated so firmly below the peritoneum of Douglas's sac, that I decided to leave a piece of the tumor half as large as a fist. At the end of a year and a half, this part had grown into a tumor which extended above the umbilicus, and weighed $3\frac{1}{2}$ kilo. It was extirpated completely, together with the perfectly normal right ovary. The latter was removed in order that the patient might not be exposed to the danger of a third ovariectomy.

But even in those cases in which larger parts of a cystoma are left behind, the further growth is exceptional, and shrivelling of the remnant is the rule. I can give definite statements concerning at least one of several cases of this kind: In December, 1878, I left behind a not inconsiderable portion of a subserous, parvilocular tumor at the base of the broad ligament, next to the cervix uteri. Two and a half years after extirpation I found that the remaining portion of the tumor had diminished in size by half, and the patient was perfectly healthy four years after the operation.

Schroeder is the only other writer who has furnished definite statements; six years after leaving part of a subserous tumor, he was compelled to operate "on account of a large relapse," and then extirpated the tumor completely. The patient recovered.

The site of the incision is the first point to be considered with regard to the technique of a second ovariectomy. It has almost always been made at a little distance from the old cicatrix, a few centimetres to the right or left. If there is some reason for selecting the old cicatrix itself—this is not contra-indicated when the scar is sufficiently soft—the sutures should be allowed to remain a long time, or the cicatrix itself may be excised. In a second laparotomy, special caution is necessary in cutting through the peritoneum, because loops of intestines may be adherent to the inner surface of the old wound. For this reason, also, it is better to keep at a little distance from the old wound. We are still more secure if the incision is made above the old cicatrix.

If the pedicle received extra-peritoneal treatment during the first operation, this merits proper attention. Keith observed a serious hemorrhage from the dilated veins of the old pedicle. As a general thing, we must expect to find more numerous adhesions.

Second ovariectomies in the same patient also possess a special pathological interest, because they show how rapidly proliferating cystomata sometimes grow from the very start. In several reported cases, the previously healthy ovary was converted within a short time into a tumor of considerable size.

The results of second ovariectomies on the same patient are by no means bad. Among Spencer Wells's thirteen cases only two terminated fatally, although these cases date back to 1863. Of the other cases which have come to my knowledge only two died, *viz.*, Bird's patient and the first of my two cases.

A second laparotomy may become necessary for other reasons than the growth of an ovarian tumor. Thus, Baumgaertner performed the second laparotomy on account of constant pains; he divided adhesions between the pedicle, bladder, omentum and intestine. Two years after the first operation he performed a third laparotomy and removed the other, non-enlarged ovary: the patient survived the last operation.

One and one half year after ovariectomy I also performed a second laparotomy on account of constant, circumscribed pains, which I attributed to adhesions. I separated numerous intestinal adhesions. The patient survived the operation, but success was not permanent. In another patient I performed three laparotomies within three years. This was done, however, in a case of hydroperysalpinx, in which the first and second operations did not effect complete extirpation. The patient was not cured completely.

CHAPTER XLV.

INDICATIONS AND CONTRA-INDICATIONS OF OVARIOTOMY.

AT the present time it is held that every enlargement of the ovary, resulting from a neoplasm, forms an indication for ovariectomy, and it is merely left for us to determine the exceptions to this rule. We must take into consideration:-

1. The character of the tumor or peculiarities which entail unusual difficulty.
2. Complicating diseases.
3. Other complications or aggravating conditions.

With regard to the anatomical character of the tumor, the question can only arise whether simple cysts, parovarian or ovarian, and malignant tumors justify ovariectomy or not. We have already expressed our opinion with regard to the former, which may be diagnosed in the majority of cases. Although mere puncture suffices, in rare cases, to secure radical recovery, or at least the removal of the tumor for years, nevertheless extirpation is the only certain means of cure, and is undoubtedly the only proper method.

Eight years ago I advised with regard to malignant tumors, that an operation should not be performed if the diagnosis is assured. This view has been justly attacked in various quarters. The results have changed materially since that time. Prior to the antiseptic period, a mere attempt at operation in cancer of the ovary was followed, as a rule, by rapid death. Now, an incision will enable us to decide whether extirpation is advisable, and in the worst event will confine the patient to bed for a couple of weeks. It is only when metastases are evident before the incision that we must desist from the exploration.

Adhesions of the tumor, which formerly played such an important part, can no longer be regarded as contra-indications, apart from the fact that, in the majority of cases, the most serious adhesions cannot be diagnosed in advance.

The conditions are somewhat different in subserous development of the tumor. It is true that I believe, with Schroeder, that this mode of development no longer contra-indicates extirpation. In very rare cases, however, when the patient is extremely feeble, the question may arise whether she will be able to survive the presumably difficult operation. This question recently presented itself to me. A very feeble

woman, aged forty-eight years, had suffered very much from her large tumor (twenty-three pounds), and could not have lived much longer. The tumor was bilateral and subserous, and evidently extended far under the pelvic peritoneum. The extirpation was presumably very difficult, perhaps impossible in its entirety. An experienced colleague had declined to perform the operation. But I was compelled to admit to myself that the patient's only chance lay in the operation, and that her brief span of life could only be a source of misery. I would not have attempted to persuade the patient to have the operation performed, but it was her urgent desire that an attempt should be made to procure relief. In such cases, but only in those in which the operator must confess that the indication is doubtful, the wishes of the patient throw a certain weight into the balance. As a matter of course, it is assumed that she has been informed of the danger of the operation.

In this case extirpation could not be performed completely. The difficult, uncleanly operation was well borne, but profuse diarrhœa set in on the tenth day, and caused death from exhaustion on the twentieth day.

Unusual size of the tumor is no longer regarded as a contra-indication to extirpation. But the question arises, What is the smallest size of an ovarian tumor, which furnishes an indication for operation? Bantock and Thornton favor an early operation. But Thornton believes that, as a rule, the operation should not be performed until the tumor has left the pelvis, and is applied to the abdominal walls under slight tension, so that the incision may be made upon the tumor, and not upon loops of intestines lying in front of it. Thornton admits exceptions in cases of specially annoying symptoms, hemorrhages and incarceration.

I believe that another point of view is to be adopted. As a matter of course, we must first be sure of the diagnosis. This is generally unattended with difficulty, even at an early period, in tumors which have grown into the abdominal cavity; while subserous tumors, even after they have attained the size of a fist on each side, may be mistaken for myomata, and especially for hæmatomata.

There must also be no doubt that we have to deal with a neoplasm and not with mere connective-tissue hyperplasia. This cannot always be ascertained with certainty in tumors as large as a goose-egg, with a smooth surface. I have two ovaries of this kind under observation at present in two patients. I am convinced that both are instances of neoplasm, perhaps of dermoid cysts, but in one no change in size has occurred in more than one and a half years. Inasmuch as symptoms are absent in both cases, I have, for the present, advised against extirpation.

Granted that an ovarian tumor is really present, the question of extirpation of small tumors depends chiefly on two points, *i.e.*, are symptoms present and will the operation probably be mild—or in other words, is the tumor pedunculated and movable? If the latter is the case, it is imma-

terial whether the tumor is still situated entirely within the pelvis, and still less whether it is applied to a certain extent to the abdominal walls. If it is as large as a fist, movable and pedunculated, especially if the pedicle is long, the patient is in less danger from the extirpation than from the tumor itself, inasmuch as torsion of the pedicle and extravasation of cyst contents into the abdominal cavity are undoubted sources of danger. It is especially owing to Thornton that stress has been laid upon the escape of cyst contents and its results, *viz.*, the formation of papilloma and carcinoma in the abdominal cavity. But the danger of torsion of the pedicle is even greater in tumors of this size.

For these reasons tumors as large as a fist, if they are pedunculated and movable, should be extirpated, even if symptoms are wanting. If they are much smaller, extirpation depends upon the severity of the symptoms and the probable difficulties of the operation.

In small intra-ligamentary tumors, whose character as ovarian has been rendered unquestionable by prolonged observation, the period of operation should be somewhat later. Although they constitute an early source of danger to the peritoneum, on account of the papillomata which they so often contain, extirpation is much more difficult when the tumor is small, the abdominal walls not distended and the intestines situated upon it.

Dermoid cysts, which can rarely be diagnosed with any degree of certainty, demand extirpation at least as early as proliferating cystomata. Although they usually grow more slowly, there is greater danger of torsion of the pedicle and suppuration.

The complications which make ovariectomy especially dangerous are peritonitis and suppuration or gangrene of parts of the tumor.

Keith was one of the first to operate during the course of an acute peritonitis, after a correct diagnosis and well-defined indication. He observed the development of peritonitis after puncture, and performed ovariectomy one week later. The loops of intestines were found distended with gas, of a dark cherry red color, and adherent to one another by means of purulent exudation. The hemorrhage was enormous, so that at the end of the operation, which lasted nearly two hours, the intestines had resumed their normal color. The patient improved at once and recovered.

Péan operated on a patient who had been under observation for some time, and had been suddenly attacked by uncontrollable vomiting. The peritoneum was found to be red and inflamed. Purulent contents exuded from the cysts of the tumor. Numerous adhesions bled considerably when divided, and required numerous artery forceps. The clamp was applied to the thick pedicle. The vomiting ceased on the very day of the operation, and the frequency of the pulse diminished. The patient recovered.

Péan operated in another case with the same result. Tracey also

operated successfully in a case in which the peritoneum presented inflammatory redness, and the abdominal cavity contained pus.

Teale operated seventeen days after a puncture which had been followed by symptoms of suppuration of the cyst and peritonitis. The patient had a high temperature (over 40°), vomited, and suffered from severe pains in the abdomen. The peritoneum was red and had a recent purulent coating. The punctured cyst contained foetid fluid and gas. The patient recovered rapidly and completely. Spencer Wells has operated repeatedly after rupture of the cyst with or without peritonitis. Among 300 ovariectomies he found cyst contents twenty-four times in the abdominal cavity, and in part, distinct peritonitic exudations. Nineteen of the twenty-four patients recovered. Schroeder operated twice in peritonitis; peritoneal drainage was employed unsuccessfully in one case; strict Listerism was carried out in the other case, and the patient recovered.

Tibbits also operated in acute peritonitis, replaced the pedicle and closed the abdominal wound. The peritonitis appeared to subside, but the patient died at the end of three days.

Thus, experience justifies extirpation in acute peritonitis, and theoretical considerations demand it. But if the peritonitis was allowed to pass over without operation, because it did not appear threatening, it is well not to delay long after the cessation of the inflammation, if this has been extensive, in order that the recent adhesions may not become firm and divided with difficulty.

The operation is still more satisfactory when the tumor is extirpated in suppuration of the cyst without peritonitis, and with it the focus of fever is removed. In 1868 Bryant asked, in discussing two cases of chronic suppuration of the cyst, what is the best treatment in such cases, and arrived at the conclusion that stitching of the sac into the wound and evacuation of the pus is the most advisable, in the hope that the sac will shrivel and disappear. The patient whom he treated in this way recovered, after having had, for two years, an abdominal fistula which secreted pus. Keith was the first to show the right path in this question. He formulated the distinct indication that the tumor is to be extirpated in suppuration of the cyst as the only hope of saving the patient. This plan was soon adopted by various other operators with good results. Recent successful operations have also been reported by Trendelenburg, Parish, Weil and Spencer Wells; Mundé and Hildebrandt operated unsuccessfully.

The two following cases will illustrate the, in part, astonishing results obtained by Keith:

In December, 1864, a patient with a large ovarian tumor arrived in Edinburgh after a long carriage ride, during which violent pains in the belly had set in. Puncture afforded no relief. Typhoid symptoms appeared (fever and delirium).

Under these conditions ovariectomy was performed. A striking feature was the deep livid, almost black, color of the intestines and their spongy softness. Recent deposits of pus were found upon the intestines and mesentery. A thick-walled cyst, whose walls had begun to gangrene in places, contained putrid ichor. At the end of the operation, which lasted nearly two hours, the patient was cold, almost pulseless, and vomited a good deal. According to Keith it looked as if he had simply operated her to death. But she soon became warm, the delirium disappeared, and recovery occurred without interruption.

Another patient, aged fifty-seven years, with a large tumor, had been punctured two months before by another physician. She was thin and pale, and the pulse was very small. Oedema of the thighs and abdominal walls necessitated another puncture. The fluid was thick and dark colored. The oedema rapidly returned, and the urine contained albumin. The patient emaciated rapidly. Pain and tenderness appeared below the left ribs. The circumference of the abdomen now measured forty-six inches; a malignant tumor was suspected. A third puncture evacuated two gallons of extremely putrid fluid. No suspicion of suppuration had been previously entertained on account of the low temperature (below 37° C.). Slight improvement continued for two days, then the pulse became more rapid and the temperature lower; tongue red and dry; diarrhoea. The features now resembled those of patients dying from ovarian disease. The patient was apathetic, hardly answered "yes" or "no," and refused food almost entirely.

Keith then performed ovariectomy under ether. The body was extremely emaciated; pulse 130 and hardly perceptible, temperature 35° C. The tumor was found in a condition of extreme gangrene, and there were numerous very firm adhesions. The posterior wall presented extensive adhesions to the gut and mesentery. The latter bled profusely when divided. At least twenty catgut ligatures were introduced. The pedicle was divided with the actual cautery, and replaced. The raw surfaces oozed a good deal, so that the sponges were required a long time and the wound was kept open five and one half hours.

The patient, when put to bed, looked like a corpse. Enemata of brandy were administered. When the patient awoke, two and one half hours later, she was warm and had a pulse of 170, which grew stronger towards morning. On the evening of the day of operation the temperature had risen 1°, the pulse was 144. On the second day the temperature rose to 38.5°, but soon fell to the normal. On the tenth day the pulse had sunk to 100, and convalescence was undisturbed.

These cases show the correctness of the indication for operation, and how apparently absolutely hopeless cases may be carried to a favorable termination. Keith says that we must have seen such cases in order to believe in the possibility of recovery. He has operated fourteen times in acute suppuration, twice in chronic suppuration. All but two recovered. This is so much more significant, because the majority of operations were complicated by very extensive adhesions, particularly to the intestines. In the cases of acute suppuration the tumor was always tender on pressure, the pulse small and frequent. In the large majority of cases there was quite marked elevation of temperature, and this always fell several degrees a few hours after the operation. But when, as in Keith's two cases, the temperature was abnormally low before the operation, it rapidly rose 1 to 1½° C. after the operation.

Keith treated five of the first ten cases with the clamp, five with the actual cautery. One death followed each form of treatment.

With regard to the extension of the indications for ovariectomy, Keith's bold plan constitutes one of the greatest advances since the origin of ovariectomy.

We must now determine to what extent complicating diseases of other kinds contra-indicate ovariectomy. All possible constitutional and organic diseases were formerly regarded as contra-indications, *viz.*, tuberculosis, heart disease, hepatic, renal, splenic and intestinal diseases, ulcer of the stomach, nervous affections, etc. It is true that under certain circumstances the condition of the patient may form a temporary contra-indication—for example, when a gastric ulcer has reduced the patient on account of hematemesis or an acute exacerbation of the symptoms has set in during the course of a cardiac or pulmonary affection. Otherwise we do not see why the operation should not be performed on a patient suffering from tuberculosis (unless she is in the last stages of phthisis) or from valvular disease of the heart, in which the removal of the tumor increases the chances for relief of the cardiac symptoms, and perhaps will even diminish the danger to life. This is still more true of certain diseases of the abdominal organs, particularly the kidneys. Not alone is simple albuminuria no contra-indication, because it may result from the presence of the tumor, but this is also true of parenchymatous nephritis, particularly as it may be aggravated by the tumor. A chronic complicating disease, which certainly forebodes a speedy fatal termination, alone may be regarded as a contra-indication.

Four and one half years ago I removed, from a woman of twenty-five years, a tumor weighing 4.5 kilo. which had grown very rapidly and caused severe compression symptoms. Considerable albuminuria was also noticed, and this has persisted until the present time. Nevertheless the patient feels much better than before the operation.

As a matter of course, the conditions are different during an acute febrile disease. In such cases extirpation should not be performed unless absolutely necessary, particularly in acute affections of the thoracic organs. Even an apyrexial catarrh is a serious matter. The cough is always annoying for the first few days after the operation, it is painful, is apt to interfere with the healing of the wound, and permits vomiting to occur more readily. Koeberlé and others have lost patients from pneumonia, which developed out of a previously existing bronchitis. Under similar conditions I observed the development of double pneumonia a few days after the operation, but the patient recovered. A mild catarrh demands special attention in old patients.

Finally, the age of the patient and certain physiological conditions must be discussed as contra-indications.

There is hardly any period of life in which ovariectomy has not been

successfully performed. Atlee operated successfully on a patient of seventy-eight years, Janvrin and Wilcke at seventy-seven years, Schroeder at seventy-nine and eighty years. Miner lost a patient aged eighty-two years, B. Barker operated successfully at seven years, Spencer Wells and Chenoweth at eight years, H. Schwartz at four years, and Kuester upon a child of one year and eight months. Alcott lost a patient of three years, Busch of two years, and Kidd one of three years. The majority of tumors extirpated in children were dermoid cysts (Kuester, Thornton, Kidd). Schwartz's case was one of proliferating cystoma weighing 4 kilo. It had distended the abdomen at the age of one and a half years, and was attended with premature development of the body and menstruation.

Hence, age never offers an absolute contra-indication. We will not operate in marantic old women, if the tumor gives rise to no disturbance, grows slowly, and appears to admit of prolonged existence, even without extirpation.

The approach of menstruation and the menstrual period are generally regarded as temporary contra-indications. Nevertheless, Storer operated successfully during menstruation.

Inasmuch as the congestion of the genital organs is undoubtedly greater before the beginning of menstruation than it is during the flow, the period just before menstruation is especially to be avoided as the time for operation. Extirpation during the menses undoubtedly increases the danger of infection, since the menstrual secretion in the vicinity of the field of operation is very susceptible of decomposition. The danger would be especially great if vaginal drainage were employed.

But if other circumstances, especially peritonitis, rupture of the cyst, torsion of the pedicle or other threatening conditions, render delay inadvisable, no attention is to be paid to menstrual congestion or hemorrhage.

Unless imperatively demanded, the operation should not be performed, for obvious reasons, during the first part of the puerperal period. But in one case Nussbaum operated on the twelfth day after delivery. Veit operated on the fourth day, on account of the marked exhaustion which attended the visible growth of the tumor. The diagnosis of torsion of the pedicle was confirmed. The extirpation was simple, but the patient died of exhaustion twelve hours after the operation. Ruge operated in the second week after confinement. The tumor had been punctured during delivery, after fruitless attempts at reduction. After the patient had felt well for a week, the temperature rose to 40°. The tumor was now situated above the pelvis. The suspected suppuration was discovered. Drainage through Douglas's sac was employed, but the patient died in two days.

We have previously shown that not alone does pregnancy not form a contra-indication, but that it increases the necessity of the operation. Hence it may be said that a contra-indication to ovariectomy is very rarely

found at the present time. The majority of operators adhere to the standpoint of Kocher, Schroeder and Billroth, that the malignant character of the tumor with the formation of metastases and complicating diseases, which will cause a rapidly fatal termination, offer the only contra-indication. Koeberlé is the only one who mentions numerous conditions and complications as contra-indications.

CHAPTER XLVI.

DERMOIDS OF THE OVARY.

THE term dermoid is applied to new formations which contain the constituents of the integument in more or less completeness. They always appear as cysts which may grow, in the ovary, to the size of a man's head. They are always simple, never proliferating cysts, but one ovary occasionally contains two dermoid cysts. I extirpated a large tumor, which consisted of a proliferating cystoma and two separate dermoids, as large as a hen's egg. In another case three dermoid cysts, weighing $\frac{3}{4}$ kilo., were found in one ovary.

As a rule, dermoid cysts are found only in a single ovary, but many cases have been reported in which both organs were affected. Pesch describes a bilateral dermoid in a woman of sixty years, Alquié in a woman of forty-nine years. Similar cases have also been reported by Pfan, Skjoeldberg, Kocher, Soeussou, Leopold, Kidd, Lusk and A. Duran. Among sixteen extirpations of dermoid cysts I found no less than four in which they were bilateral.

The walls of the cyst are often quite thick, but sometimes very delicate. The inner surface is either perfectly smooth or it presents round spots of various sizes, which look like skin and project several millimeters above the surrounding parts. The entire inner surface is lined with several layers of epidermoidal cells, the upper ones flat and non-nucleated, the underlying ones round and nucleated. These cells are connected with the firm, outer fibrous layer of the cyst wall by an underlying connective-tissue layer, which is analogous to the corium.

The structure of the skin is distinctly shown only by the projecting portions of the wall. Here the epidermoidal cell layers are followed by a distinct corium, with an underlying panniculus adiposus, the latter being in apposition with the connective-tissue membrane forming the outer wall. The corium often, though not certainly, contains papillæ which, although often in close apposition, never present a regular arrangement and vary greatly in length. The skin-like portions of the inner wall also contain a number of usually short hairs, which sprout from the surface. They present all the constituents of other hairs, are situated in hair follicles, and the latter are sometimes provided with sebaceous glands. Some of the sebaceous glands empty, contrary to the normal condition,

immediately below the surface of the epidermis, others directly upon the surface of the epidermis. Sweat glands are found less constantly than sebaceous glands.

In a few dermoid cysts the perfectly smooth and very thin walls contain hardly anything else than a few layers of epidermis cells, and beneath them a small amount of connective tissue, without any glandular structures, papillæ or hairs. In such cases we must assume an atrophy and disappearance of the hair follicles and sebaceous glands, inasmuch as the contents of the cyst prove that these tissues had been present.

The dermoid cysts usually contain, in part a thick oily fluid, in part a smeary mass, like the vernix caseosa, consisting of yellow, soft fat and epidermis cells. This mass contains more or less numerous matted hairs. A tolerably large knot of hairs is often situated in the middle of the fatty mass. They are almost always light blond, even in negresses, occasionally reddish, very rarely dark. Their length varies from a few inches to several feet, the majority being only a few inches long. In rare cases the hair is arranged in locks.

The mass of fat, which fills the cyst completely after it grows cold, occasionally contains crystals of cholestearin, but rarely to any great extent. A portion of the fat is fluid immediately after extirpation; its melting point is approximately at the temperature of the body. It rarely remains fluid after growing cold.

The fatty mass presented a peculiar appearance in Rokitansky's and Routh's cases. It formed innumerable round globules instead of a single coherent mass. Rokitansky counted seventy globules as large as a nut and very many of the size of a pea; they floated in a dirty brown fluid. The cyst was twisted twice upon its pedicle. An extravasation of blood and perhaps a transudation had occurred into the cyst, and this admixture had probably separated the fatty mass into separate globules. It can hardly be attributed, as Rokitansky believed, to the rotary movement during torsion of the pedicle. Whether similar conditions obtained in Routh's case (to which Spencer Wells refers) is not mentioned. The globules contained, as in Rokitansky's case, concentric layers of amorphous fats and a nucleus of cholestearin crystals. Fraenkel observed a similar case. The entire contents of the cyst were composed of numerous hard, usually round, but partly irregular larger and smaller clumps consisting of fatty and cornified epithelium, amorphous fat and hairs.

Bones and teeth are among the less constant constituents of dermoid cysts. The bones are situated in the connective-tissue layer of the wall and are covered internally by more or less developed tegumentary structures. They generally form plates of irregular shape and varying thickness. Compact osseous substance predominates. In rare cases several pieces of bone are connected by joint capsules and cartilaginous coverings of the joint ends.

The teeth are situated in great part in the connective-tissue wall, and in part project into the cavity. In rarer cases they are entirely inclosed

in the wall. They are often situated in bony plates, which then contain alveoli. The teeth are usually fixed loosely in the alveoli. They very often possess all the elements of normal teeth. Many are rudimentary; the cement is often absent. The fully developed teeth may be shaped distinctly like the incisors, canines or molars, but the perfectly regular shape of normal teeth is wanting, so that it is usually evident that they are not derived from the mouth. But like the teeth of the mouth they possess a crown which slopes slightly towards the median plane of the body, so that we can ascertain upon which side of the body the cyst was situated by examining the teeth contained in it. My attention was called to this point by Prof. Hollander, who furnished various proofs of the correctness of this statement.

Among 129 cases collected by Lebert teeth were present sixty-three times, but only forty-six times in 245 other cases collected by Pauly. There are usually only one or a few teeth present, but large numbers have also been found. In the dermoid cyst of a girl of thirteen years Schnabel found, in three bony plates, more than 100 teeth which were well developed with the exception of the usually imperfect roots. Plouguet and Autenrieth described the cyst of a woman aged twenty-two years, from which 300 teeth were removed, while a still larger number were left behind.

Such a large number of teeth can only be explained on the assumption that they continue to grow. That this really occurs is proven by a preparation in Rokitansky's collection, in which a milk tooth was absorbed as far as the crown, by another tooth growing beneath it.

The discovery of nerve substance in the cysts is not alone important, but is the source of renewed difficulty in the explanation of the development of these tumors. Klebs says: "The gray nerve substance of dermoid cysts generally contains the constituents of the normal gray matter of the central nervous system, more rarely medullated fibres. This substance usually forms soft, grayish red nodules, which project into the cavity of the cyst, and are in apposition with the dermoid structures." In one case Virchow found the nerve substance laminated as in the cerebellum. Key found it imbedded in a bone cavity, Rokitansky found it in a sort of capsule within the cyst-wall, near the base of a piece of bone. A nerve twig passed from the ganglionic mass to the tip of the piece of bone, and finer branches to the tegumentary covering.

The smooth muscular fibres, which Virchow found in dermoid cysts, were regarded by him as *arrectores pili*. Striated muscle has never been found in pure dermoids of the ovary, but has been seen in the closely allied teratomata. This is also true of nails, with the exception of one case in which Cruveilhier depicts a dermoid cyst with nail-like structures. But it would not be astonishing if nails were found more frequently in dermoid cysts, inasmuch as they contain wool in the sheep, cow-hair in cows, and feathers in birds. The Museum of the Gynecological Clinic at

Halle contains a preparation of a dermoid cyst of a goose with numerous feathers.

The combination of dermoid cysts with various degenerations of the stroma, especially colloid degeneration, is of no slight pathological and very great clinical interest. This combination is not very rare. Lebert collected seventeen cases of this kind, and numerous ones have since been reported by Spencer Wells, Braun, Eichwald, Virchow and others. Among twenty dermoid cysts extirpated in sixteen patients, I have seen three cases, in which there was a combination with proliferating cystoma.

In the majority of these cases a larger or smaller dermoid cyst is found in the same ovary with an extensive proliferating cystoma. The latter is the chief cause of the enlargement of the organ, and furnishes the indication for surgical interference. The dermoid cyst is only a small part of the tumor, and is applied to the main wall of the proliferating cyst. The latter is to be regarded as an accidental development in an ovary which already contained a dermoid cyst. The dermoid may have furnished the irritation which led to degeneration of the adjacent parenchyma.

In some dermoid cysts, however, the inner surface presents in part the character of the cutis, in part it contains epithelial cells and the beginnings of glandular formations. Flesch has very accurately described a case of this kind. Here the inner surface of some cysts was purely epithelial; others presented the tegumentary structure in places, the epidermoidal cells being situated upon cylindrical epithelium. The contents were partly colloid, partly those of dermoid cysts. Numerous pearly globules were also present. Hair, sebaceous and sweat glands and pieces of bone were not wanting. The normal elements of the ovarian parenchyma and the cutis thus took part at the same time in the development of the same cysts. A notable fact was the presence of ciliated epithelium in places, as has also been described by Virchow and others.

We thus see that this form of combined tumors may vary essentially, according to the mere juxtaposition of the epithelial and epidermoidal structures or their growth into one another. Friedlaender has described a quite large ovarian tumor, in which cysts filled with masses of fat and hair and cysts filled with serous fluid were apparently associated in an irregular manner. But the tumor was a pure dermoid cyst with unusual secondary changes. The sweat glands of the dermoid had been converted into retention-cysts as large as a fist. This is so much the more remarkable in view of the fact that dilatations of the sweat glands are very rarely observed. These cysts, with a delicate wall and perfectly clear, thin contents, had grown from the wall of the simple dermoid cysts into their lumen in such a way that the cavity appeared to be converted into a number of distinct cysts, but which proved to be in communication with one another. The sebaceous glands in the walls of the main cysts were also in a condition of secretion-retention, so that they corresponded to

milium, acne and atheroma cysts. Dohrn's case probably belongs to the same category. On puncture of an ovarian tumor, which proved subsequently to be a dermoid, he evacuated a perfectly clear fluid, with a sp. gr. of 100.4, which contained no albumin.

In some cases, finally, a dermoid cyst in one ovary is associated with a proliferating cystoma in the other.

The combination of a dermoid cyst with a malignant neoplasm in the same tumor has been repeatedly observed in recent times. Thornton found a sarcoma and dermoid in the same ovary. Kocher found in a bilateral dermoid, that one tumor had degenerated into medullary carcinoma. In a woman aged forty-five years, Heschl found a nodular, grayish red mass, as large as a fist, imbedded in the wall of a dermoid cyst, and projecting with its inner, degenerating surface into the lumen of the cyst. Microscopical examination left no doubt of its cancerous nature. Wahl extirpated a cancerous dermoid cyst, and was compelled, at the same time, to resect a piece of colon 12 cm. long, because the malignant growth had attacked the intestine. The patient recovered. Berner found, on autopsy, a dermoid in one ovary, a sarcoma in the other.

Special interest attaches to a mixed tumor of more complicated structure, which was accurately described by Fleischlen. One ovary contained a dermoid cyst, a proliferating cystoma, and sarcomatous degeneration of the connective tissue. The cyst-walls were in a condition of sarcomatous degeneration, but still contained follicles. Cell strands, whose elements looked like homogeneous, free nuclei, were found in spaces arranged like vessels. Fleischlen was unable to find any transitions into vessel lumina nor an endothelial lining of the spaces. The connective tissue surrounding the cell strands was in a condition of hyaline degeneration in places. Other spaces contained very granular, cellular elements; finally, there was pure sarcomatous degeneration of the connective tissue. This testifies in favor of the connective-tissue origin of the process.

Fleischlen also describes another ovary in which a pigment cyst, a dermoid cyst, and the beginning of colloid cyst formation were found, in addition to embryonal and normal ovarian parenchyma.

Unverricht published the following interesting case: In a woman aged twenty-four years, an abdominal tumor grew to the size of a child's head, associated with ascites. At the autopsy the right ovary was found to be healthy. The tumor of the left ovary presented, in addition to the characteristic constituents of a dermoid, grayish red medullary masses which were inclosed, as distinct tumor nodules, in connective tissue capsules. It was a round cell sarcoma. Tumors of a similar nature were found at the cervix uteri, on the peritoneum, omentum and diaphragm, and in the liver.

Several observers have recently reported metastases of dermoid cysts. Kolaczek reports the following: In an unmarried woman, aged forty-seven

years, the abdomen had been enlarging for seven years. On laparotomy Martin found an ordinary dermoid as large as a man's head. The tumor had a thick wall and perfectly smooth surface, upon which dermoid structures were nowhere visible. After the escape of considerable serous transudation numerous yellowish nodules, almost as large as a pea, were seen on the peritoneum. Many of them contained a fine, light-colored downy hair, 1 cm. long, which projected free into the abdominal cavity. The microscope showed that the structure of the hairs was normal.

Fränkel also observed dermoids of the abdominal cavity, associated with an ovarian dermoid in one of Billroth's ovariectomies. Fränkel thinks it probable that the dermoid elements were disseminated as the result of rupture of the cyst.

Litten has published the following case: The external genitals of a girl of sixteen years were very similar to those of the male, on account of abnormal size of the clitoris and bilateral hydrocele cystica proc. vag. peritonei. The left ovary was small and smooth, the right ovary was converted into a tumor of considerable size, whose surface bore a large number of very prominent, thin cysts, like those of a proliferating cystoma. In addition there were found hairs, large medullated nerves, smooth muscular fibres, islets of hyaline cartilage, spots resembling round cell sarcoma under the microscope, and nodules of myxoma tissue as large as a hazel nut. In the liver were nodules containing larger and smaller cysts, while the surrounding stroma resembled the myxomatous and sarcomatous portions of the ovarian tumor.

If we remember that peritoneal metastases have been repeatedly observed in proliferating cystoma, and that they occur very frequently in papillary cystomata, we will not be astonished at their occurrence in dermoids, and will no longer doubt the authenticity of the reported cases. Moreover, much more extensive metastases have been observed in a case which will soon be mentioned. Due weight must also be attached to A. Doran's statement, that he has repeatedly observed the development of malignant tumors in the abdomen after extirpation of dermoids.

The dermoids are allied, to a certain extent, to the much rarer teratomata of the ovary. They differ from the former in the fact that they contain structures of the mesoderm and entoderm in addition to those of the ectoderm. Remarkably few cases have been hitherto observed.

Thornton mentions a case which belongs, perhaps, in this category. He extirpated a cyst which contained a remarkably firm mass, that was covered with integument and long hairs, and resembled a child's head. A bone with various teeth projected from it, while a small prominence, which resembled an aborted limb, protruded from another portion of the surface; it was provided with very long nails. The description is somewhat meagre, and it cannot be decided with certainty whether the case was one of simple dermoid cyst or teratoma.

Marchand's case is described more completely. The tumor weighing 5400 gr. was $28 \times 21 \times 16$ cm. in size, had a perfectly smooth surface without any large cavity, but contained on section a number of sector-shaped lobes with a structure like that of a honey-comb. Between the small cysts, whose contents were partly colloid, partly thin and colorless, were small yellowish patches from which fine hairs protruded. In many places a grayish red, medullary, sarcoma-like appearance was noticeable instead of the cystic structure.

In addition to almost all the structures of the skin, the microscope showed the following elements: bone, cartilage, teeth, cylindrical and ciliated epithelium, pigment epithelium, myxomatous and sarcomatous tissue, smooth and striated muscular fibres, medullated nerve fibres, ganglion cells, little cysts with cup cells, whose structure resembled that of the intestinal glands.

Two theories are now entertained concerning the origin of these peculiar structures. Some assume an inclusion of abnormal parts in the ovary during foetal life; others attribute them to an unusual formative tendency of the elements of the ovarian parenchyma.

The former theory was started by Heschl, who believes with regard to dermoid cysts, which are not situated in the interior of the body, that portions of the tegumentary layer penetrate deeply during foetal life, are there constricted and deposit the germ which will develop later into a dermoid. Heschl offered no explanation for the development of ovarian dermoids, but they were explained on the same theory by other writers. But this theory is only conceivable with regard to ovarian dermoids, since His has published his investigations concerning the axial strand, from which, according to him, the genitalia develop. Parts which correspond to all the foetal layers, participate in the formation of the axial strand. A differentiation of germinal layers in it is impossible, and hence it is conceivable that parts may stray into the ovary, which correspond to the horny layer or the middle germinal layer (muscles, bones). Thus the theory of foetal inclusion, although interpreted somewhat differently with regard to the generative gland than to subcutaneous dermoids, meets the requirements which must be made upon it, in order that it should not be a mere baseless hypothesis.

It is, therefore, so much more astonishing that Waldeyer has recently returned to the notion of a special formative power of the elements of the ovary. He thinks that the epithelium cells of the ovary, since they are genetically co-ordinate with the ovarian cell, may exceptionally be able to produce other products than epithelium. This process would be entirely parallel with the production of cellular structures from the ovarian elements, and would explain the coincident occurrence of myxoid and dermoid formations in the same ovary. If the process goes on to the production of fully-formed integument with all its appendages, of bone

teeth, nerve substance and perhaps muscles, this production almost deserves the name of parthenogenetic development.

This theory seems to have two weak sides. In the first place, it depends on a possibility by indirect proof; secondly, it explains only ovarian dermoids and not the much more numerous subcutaneous dermoids. It implies the necessity, therefore, of advancing two distinct theories for the development of apparently the same structures.

The occurrence of teratomata offers a certain support for the theory of the spontaneous development of ovum cells into other structures and organs. But it must not be forgotten that teratomata appear much more frequently and perfectly in other parts of the body (the sacral region, scrobiculus cordis and hard palate) in which such an explanation is impossible. It is, therefore, probable that the development of teratomata in the ovary is merely the result of foetal inclusion, and that there is no essential genetic difference between ovarian dermoids and teratomata.

In one of the above-mentioned cases, in which a pigment cyst and dermoid cyst were associated with the beginning of colloid cyst formation, Flaischlen attempted to show that all these structures developed from the embryonal parenchyma of the ovary. Flat epithelium and glandular epithelium were directly continuous; the bones of the dermoid cyst were derived directly from the connective tissue of the periosteum. Flaischlen therefore regards Waldeyer's hypothesis as unfounded. Doran claims to have seen the beginnings of dermoid in Graafian follicles, which were not provided with a *membrana granulosa*.

We have previously mentioned that dermoids occur in early childhood. They are the most frequent form of ovarian tumor until the period of puberty. At the latter period and immediately after, unilocular cysts with serous contents, chiefly parovarian, are more frequent than dermoids. Beyond the age of twenty-five years proliferating cystomata predominate.

But the absolute majority of dermoid cysts is observed after the period of puberty, the greatest number being seen between the ages of twenty and forty years. Among 197 cases collated by Pauly, Lebert and myself, seven occurred in the first decennium, thirty-five in the second decennium, forty-nine in the third decennium, forty-four in the fourth decennium, thirty-seven in the fifth decennium, seventeen in the sixth decennium, four in the seventh decennium, and three beyond the age of seventy years.

Pigné makes the following statements with regard to their occurrence in early life; among eighteen cases there were three premature births and four stillborn infants at full term; six were below the age of two years and five below the age of twelve years. Dermoids grow rarer with advancing years, but they are even seen in very old age. In an autopsy on a woman of eighty-three years, Potter found a dermoid cyst, weighing eighty-nine ounces, which had never given rise to symptoms. The pedicle was twisted.

The occurrence of the dermoid at all periods of life in conjunction with the anatomical structure of the tumors, which proves their foetal origin, forces us to conclude that dermoids often present extremely slight growth for years, and that they may remain in the foetal condition for a long time or even permanently without evincing any growth.

Their more frequent occurrence at the period of puberty is evidently associated with their more rapid growth, incident upon the development of the genital organs at this period. According to A. W. Freund the genitalia not infrequently present the infantile type, or are imperfectly developed in cases of dermoid cysts. The comparatively large number of cases of this kind which have been reported, shows that the connection is not an accidental one. A similar relation has also been observed in other tumors. In 1881, I extirpated a large, proliferating cystoma from a girl of sixteen years. The patient had never menstruated and her bodily development resembled that of a child of ten to twelve years.

The opposite relation is observed less frequently. Foulis reports the case of a child of thirteen years, from whom Keith had removed a dermoid cyst with black hairs 4" in length. This girl had fully developed pubes with black hair. Schwartz also mentions a case of large proliferating cystoma in a child of four years, who presented premature bodily development, and had bloody discharges from the genitals. Similar cases in tumors of the genitalia are mentioned by Kussmaul in his excellent work on premature puberty.

The more frequent occurrence of imperfect bodily development must be explained on the ground that the new formation or the foetal tumor development impairs the formation of normal ovarian parenchyma, and thus inhibits, to a certain extent, the entire development of the body.

The tables of various operators show great differences with regard to the frequency of occurrence of dermoid cysts among ovarian tumors. Spencer Wells's percentage of cases is unusually small, but he has not included those in which small dermoid cysts were found in a large tumor of another kind.

Spencer Wells found 22 dermoids among 1000 ovariectomies.

Olshausen	"	16	"	"	320	"
Keith	"	7	"	"	268	"
Schroeder	"	9	"	"	202	"
Krassowski	"	3	"	"	128	"
A. Martin	"	5	"	"	104	"
Billroth	"	7	"	"	86	"
K. v. Braun	"	5	"	"	84	"
Esmarch	"	1	"	"	58	"
Dohrn	"	5	"	"	25	"
<hr/>						
80 (3.5%)					2275	"

If we include all tumors which contain dermoid cysts, the percentage will probably be 4 to 5.

The course and symptoms of dermoid cysts vary extremely. In some cases the tumors remain small for life without producing any symptoms, and are discovered accidentally on autopsy at an advanced age. In other cases they give rise to the most important and serious symptoms, not infrequently with a fatal termination.

Compared with proliferating and serous cysts of the ovary, the difference in the symptoms of dermoid cysts results chiefly from the following circumstances: the slow growth of the tumors and their frequent retention in the pelvis for years, their great tendency to undergo inflammation and to produce peritonitic inflammations in the vicinity, finally, their greater tendency to torsion of the pedicle. Inflammation of the cyst-walls gives rise to suppuration and very often to gangrene of the contents. Rupture into other organs is the usual result in both events. On account of the deep situation of dermoids in the pelvis, perforation takes place most frequently into the rectum or vagina, and not very rarely into the bladder. A rapidly fatal termination from acute general peritonitis generally follows the not very common rupture into the abdominal cavity. In some cases attacks of violent pain, which cannot be explained, occur in dermoid cysts without peritonitis.

Numerous patients with small dermoid cysts have, for years, only slight symptoms of pressure on the pelvic organs, symptoms which are tolerated without medical interference until the tumor undergoes some change.

Aid is sought on account of an acute, or slowly developing, but considerable enlargement of the tumor, or an acute peritonitis, or finally suppuration of the cyst.

Notable enlargement of dermoid cysts depends upon the secondary development of colloid degeneration, or, more rarely, the formation of retention-cysts in the dermoid cysts themselves. In both cases the clinical symptoms are those of ordinary multilocular cystomata.

The great tendency of dermoid cysts to suppuration and gangrene undoubtedly depends upon their long-protracted position in the pelvis, where they are exposed to injuries of various kinds, or, on account of their permanent pressure on the floor of Douglas's sac, produce an adhesive peritonitis, which brings them in intimate contact with the rectum. This involves the danger of the introduction of micro-organisms, which lead to suppuration or gangrene. There is also reason for believing that the contents of dermoid cysts are a more suitable culture fluid for infection-carriers than the colloid substance of ordinary proliferating cystomata.

The symptoms of suppuration or gangrene are the usual ones of these conditions: considerable fever of a more or less hectic type, chills, rapid

exhaustion of the vital energies, peritonitides. Intestinal catarrh often develops. Death then results from exhaustion, unless the contents of the cyst are evacuated spontaneously or artificially. If rupture occurs into the vagina or rectum, life is often saved and the sac may shrink into a cicatrix. Rupture towards the abdominal walls is less favorable. Perforation into the bladder is still more unfavorable. Although the fatty contents, which have been converted into fluid ichor, may readily escape through the urethra, the twisted masses of hair are evacuated with much greater difficulty. They often occlude the opening in perforation in other directions, and give rise to renewed stagnation of pus and renewed fever.

If recovery finally occurs, months and years may elapse according to the position of the opening and various other circumstances.

Parturition is the most frequent starting-point for such processes, whether the tumor has formed an obstacle to delivery or has remained unnoticed. This is also true, to a certain extent, of the acute peritonitides, which are so frequent in dermoid cysts. The inflammation not infrequently follows very closely on parturition, and, as a rule, the cause cannot be recognized at first. It is not until the acute inflammation has subsided or the patient has recovered, that the tumor is discovered as the starting-point.

The tendency to peritonitis depends partly on the contusions of the tumor in the pelvis, perhaps partly on perforation of the cyst, after which the extravasated contents are rapidly encapsulated before a diffuse peritonitis occurs. Numerous cases of suppuration or gangrene during the puerperal condition have been reported. The frequent torsions of the pedicle and their results have been discussed in Chap. XVII.

The diagnosis of dermoid cysts can only be made with certainty after the contents of the cyst have become visible as the result of puncture or spontaneous perforation. In many cases, however, exploratory puncture throws no light on the question. Apart from this, there are very few and uncertain data which will enable us to recognize an ovarian tumor as a dermoid cyst. The small size of the tumor in the pelvis is only a significant sign when the tumor has been known to have been present for years. The diagnosis is so much more probable the younger the patient. Acute peritonitis with a tumor not larger than a head, and the distinct symptoms of spontaneous suppuration, especially when both conditions follow parturition, may increase our suspicion of a dermoid cyst, but in themselves do not warrant a probable diagnosis. The doughy consistence of the tumor, which is so often mentioned as a diagnostic sign, is hardly ever noticeable, because the fatty contents, particularly the outer layers, are usually in a thick fluid condition at the temperature of the body. But the tumor does not often possess a distinctly cystic feel, because the thick, tense wall yields too little. Small tumors, which are situated en-

tirely within the pelvis, especially if they are somewhat incarcerated, generally feel solid on vaginal exploration, so that the question of the presence of a fibroma arises. It will rarely be possible to make a diagnosis of dermoid from the palpation of bony parts in the walls, especially since calcification occurs in the walls of other cysts. In several cases, however, Spencer Wells based a correct diagnosis on this feature.

The prognosis is, in general, better than in proliferating cystoma, in so far as the growth of the tumor only endangers life when it is complicated with colloid degeneration.

Otherwise the dermoid may exist for years or for a lifetime without any notable growth or symptoms. The complication with pregnancy and childbed always aggravates the prognosis. But the majority of cases of suppuration terminate favorably in perforation, although the fistula often remains open for a long time. The prognosis as regards extirpation is poorer than in proliferating cystoma.

The treatment is purely surgical. Simple puncture is never advisable, since it entails great dangers without offering any hope of radical recovery. An exploratory puncture, even with the finest canula, is absolutely to be avoided whenever there is a suspicion of a dermoid cyst. The escape of the cyst contents into the abdominal cavity produces the most violent, often fatal peritonitis. This occurred in a number of recent cases, for example, those of Zweifel, Jacobi and Garrigues. In the latter case aspiration was performed with a Pravaz syringe; death occurred at the end of two weeks. Ahlfeld had the misfortune to rupture a dermoid cyst as he was lifting it out of the abdomen during laparotomy. Sepsis set in, with a fatal termination forty-four hours after the operation.

Incision and permanent drainage are more worthy of consideration in those dermoid cysts which have perforated externally or into a hollow viscus. The usually narrow fistulous track is dilated, the cyst evacuated as thoroughly as possible, its inner surface scraped with a sharp spoon, in order to destroy the dermoid structures as completely as possible, free escape for the pus (gauze drainage) is to be secured, and irrigations vigorously performed.

Schueller and Bernutz prefer this mode of treatment to extirpation. It is true that it is adapted to certain cases and must first be employed. But all our efforts to effect closure of the fistula are sometimes useless, and extirpation then remains the sole means of securing radical recovery.

But the special conditions must be weighed in each case. The site of perforation has an especially important bearing on the treatment. If the perforation has taken place into the intestine, or bladder,¹ or even into

¹ Czerny successfully extirpated a dermoid cyst which had ruptured into the bladder.

the vagina, extirpation is always disadvantageous, because it produces an opening of the viscus into the abdominal cavity. Under such circumstances, furthermore, the deep situation of the tumor in the pelvis, and the usually total adhesion of suppurating cysts to adjacent parts, will make the operation as difficult as it is dangerous. On account of the deep position of the perforation, the incision and irrigation of the pus sac can always be performed without special difficulty in perforation into the vagina, and very often in perforation into the rectum. The operation will be most difficult after rupture into the bladder. But in dilatation of the urethra, we have now a measure at our command which can not be valued too highly in enabling us to aid the efforts of Nature. But if perforation has occurred through the abdominal walls, extirpation offers much more chance of success on account of the higher position of the tumor in the abdomen.

In a case of perforation of a dermoid cyst, towards the crest of the ilium, we long attempted, without success, to effect recovery by means of dilatation of the fistula, curetting, injections and irrigations. E. Schwarz then performed extirpation with successful results.

If a dermoid tumor has not suppurated and perforated, extirpation, as a rule, must be performed. There is so much less reason for acting differently than in proliferating cystoma, because, as a general thing, only a probable diagnosis of dermoid cyst can be made. If the diagnosis is very probable, the indication is more urgent in young individuals, especially when married, because parturition and childbed materially increase the dangers arising from dermoid cysts.

The results of ovariectomy in dermoid cysts are probably equal to those in proliferating cystomata. It is true that some operations are remarkably difficult, on account of general adhesions of the entire tumor, but in the majority of cases the small tumor may be removed without being diminished in size, and the operation is thus made simple and cleanly. Spencer Wells had eighteen recoveries among his first twenty dermoid extirpations, a remarkably favorable result if we bear in mind how many years back these operations date. Since I have adopted antisepsis, I extirpated thirteen dermoids with twelve recoveries. All of Dohrn's five cases recovered.

The only rule to be made with regard to ovariectomy, is that the tumor should be removed without being diminished in size, even if the incision must be made unusually large. The yellowish wall, which feels remarkably smooth (filtration of fat), may call attention, from a mere view of the tumor, to its dangerous contents, and may warn us against puncture. But if puncture has been performed and the contents recognized on withdrawal of the trocar, the opening should be closed with the fingers as rapidly as possible, and then sutured with a fine needle, the assistant

at the same time guarding the abdominal cavity by means of sponges. After closing the opening of perforation, the abdominal incision is enlarged, if necessary, and the tumor lifted out by placing the hand behind it.

If the abdominal cavity has been soiled by contents of the dermoid cysts, the most scrupulous cleansing of the peritoneal cavity is required. But not every such soiling is necessarily followed by reaction or sepsis.

CHAPTER XLVII.

SOLID OVARIAN TUMORS.

THESE are much rarer than cystic tumors. Billroth saw three sarcomas and five cancers among eighty-six extirpations of ovarian tumors, Schroeder five sarcomas among 102 cases, Thornton ten solid tumors among 338 cases, Hildebrandt three fibromas and seven cancers among thirty-seven cases, F. Weber fifty-one solid tumors (!) among 123 cases, Krassowski not a single one among 128 cases, Braun ten solid tumors among eighty-one cases, Keith seventeen solid growths among 200 cases. Among 293 of my own cases there were twenty-six solid tumors (five carcinomata, nine sarcomata, three cysto-sarcomata, six fibromata, two fibro-adenomata, one endothelioma.)

Among the 1,388 ovariectomies just mentioned, there were 137 solid tumors (9.9 per cent.). This figure is undoubtedly too high, and results chiefly from Weber's percentage, which is so high as to rouse the suspicion that he included parvilocular cystomata among solid tumors. But if we remember, on the other hand, that comparatively many solid tumors are excluded from operation, five per cent. will not appear too high a figure.

The solid tumors are divided into two groups, desmoid and epithelial. The former includes fibroma, sarcoma, myxoma, endothelioma, papilloma and enchondroma. The epithelial group is represented almost exclusively by carcinoma, inasmuch as pure adenoma of the ovary always appears as cystoma.

The solid tumors also include mixed forms, in which a strict differentiation is impossible. Transitions between fibroma and sarcoma, and between adenoma and fibroma or sarcoma, are especially apt to occur. Sarcoma and carcinoma play the most important part as regards frequency.

We will first consider certain peculiarities manifested more or less constantly by all forms of solid growths.

In the first place they are much more often bilateral than cystomata; this is particularly true of cancer and sarcoma.

They are usually moderate in size. Although a few enormous tumors have been reported, the large majority do not attain the size of a man's head.

The shape is much less irregular than that of cystomata. The latter

are almost always exquisitely nodular, while solid tumors retain the general shape of the normal ovary. This is owing to the fact that solid neoplasms are dependent on a degeneration of the tissues, which affects the entire ovary simultaneously, so that it enlarges uniformly on all sides, while in proliferating cystoma, the irregularly developing cysts always grow towards the side of least resistance.

The fact that solid growths generally present fewer adhesions than cystoma, depends partly on their smaller size, partly on the frequency of ascitic accumulations.

The pedicle of the tumors is often composed almost exclusively of the *ala vesperilionis*, while its usual components, *viz.*, the tube and ovarian ligament, remain quite intact in their normal position.

The uniformly enlarging ovary is supported merely by a small piece of the peritoneal reduplication, which is short, but usually quite broad. The unusual width is explained by the growth of the parts composing



FIG. 34.—BILATERAL FIBRO-SARCOMA OF THE OVARIES.

the pedicle. In solid tumors the hilus of the ovary forms a more or less deep groove, around which the adjacent ovarian tissue proliferates. The tube does not run a long distance across the tumor as in cystoma, but retains its mobility as in the normal ovary. Fig. 34 is a good illustration of this mode of development of the pedicle. But there are also exceptions in this respect. The pedicle may be very thick and massive, and in some cases is entirely absent. The tumor may even have an intraligamentary situation in part.

Leopold was unable to find, in solid tumors, the connective-tissue thickening, which is generally present at the transition of the pedicle into cystomata.

The structure of the pedicle, which is composed of membranous tissues, must favor torsion, although its shortness and breadth must tend to prevent it. This structure of the pedicle also explains the fact that Klob found the tube entirely unaffected in torsion (one and a half times) of the pedicle of a fibroma as large as a child's head.

The position of the tumors may be as varied as that of cystomata.

So long as they remain in the pelvis, a form of incarceration is more apt to develop, inasmuch as the passage of the growing tumor into the abdomen is made difficult by its unyielding character. The tumor displaces adjacent organs, especially the uterus, in the same way as cystomata.

The frequency of ascites in solid tumors possesses special clinical importance. This complication occurs particularly in cancers, but is also much more frequent in sarcomas and fibromas than in cystomata, in which considerable ascites is rare.

As a rule, the ascites prevents the development of adhesions, particularly as it is apt to occur at an early period, while the tumor is still small. The tumor often possesses great mobility in the large ascitic accumulation.

Apart from the not infrequent cases of metastases on the peritoneum, the development of ascites can only be attributed to irritation of the peritoneum by the tumor. The small size and position of the tumor almost always exclude stasis. The direct dependence of the ascites on the tumor is evident in almost every case, inasmuch as it rapidly returns after puncture, while it remains absent, without further treatment, after extirpation of the tumor.

We will now pass to the consideration of the individual forms of solid tumors.

FIBROMATA OF THE OVARIES.

Fibromata of the ovaries are very rare tumors. They can never be isolated, like fibro-myomata of the uterus, from the mother structure, but are hyperplasie of the stroma, diffuse connective-tissue new-formations, which are partly the terminations of acute or chronic inflammations. According to Kiwisch these inflammations are often puerperal.

One or both ovaries may be affected. The organ attacked usually attains the size of a walnut or goose-egg.

The surface is smooth or nodular, finely lobulated. The organ is extremely rigid, and, as a rule, the follicles and even the cicatrices of ruptured follicles are destroyed in the firm connective tissue, without leaving a trace. In some cases, however, they are retained in a changed form.

The outer surface of the ovary is often thickened by deposits of false membranes, and the organ is not infrequently displaced. In other cases it is perfectly smooth and found in its normal position.

As a matter of course, this form of connective-tissue proliferation cannot produce symptoms. If the disease is bilateral, sterility will be, at the most, the only clinically important result.

In the cases described, we can hardly refer to an ovarian tumor, but this is not true of another series of cases, to which the term fibroids might be more properly applied.

The fibroid ovarian tumor forms a hard, round, smooth or nodular body, which is often sharply defined, but is hardly ever imbedded loosely

in the ovarian stroma. It usually passes imperceptibly into the latter. The entire ovary is sometimes degenerated uniformly, sometimes affected only in part, while the remaining parenchyma is normal. The disease most frequently attacks the lateral extremity. When the ovary contains a number of larger nodules, it is sometimes possible to demonstrate the origin of individual proliferations from various points of the albuginea. Virchow says "the portion of the ovary which is not involved in the formation of the tumor very often presents the changes of chronic oöphoritis in all its forms. Not alone is the stroma generally indurated, but the albuginea is thickened and sclerotic, and the follicles converted into corpora fibrosa."

The origin of fibromata from the external surface or from the theca ovarii, has been repeatedly observed. In Goodhart's case the diameter of the tumor measured 3.8 cm. On section it was evident that it had grown out of the external layers of the ovarian stroma. In Crisp's case a round, nodular tumor, weighing 3.6 kilo., was connected with the left ovary by means of a pedicle. Finally, Lloyd Roberts showed a tumor, weighing 1.87 kilo., solid throughout with concentric fibrillation, which was connected with the right ovary by a long pedicle.

These tumors may be purely fibrous or they may also contain smooth, muscular fibres. The latter are always scanty, so that the tumors resemble the harder uterine myomata more closely. The fibrous bands of the firm connective tissue cross one another in all directions, usually without any regular arrangement, and rarely present a certain degree of concentric arrangement. Towards the healthy part of the ovary or the hilus, the fibres pass directly into the stroma. As a general thing, there is no distinct separation from the albuginea. The entire tumor is devoid of larger vessels, although there are exceptions to this rule.

In a fibroma weighing nine pounds, Scanzoni found the vessels dilated to such an extent that the growth almost resembled a cavernous tumor. Daunien describes a similar case. The tumor measured $22 \times 18 \times 6$ cm. and weighed 1050 gr. It had a shape like the normal ovary, the surface was smooth, the consistence doughy. As in the normal ovary, the vessels were wider in the region of the hilus and in the centre, while hardly any but capillary vessels were found towards the periphery. There was torsion of the pedicle in this case, and it is not improbable that the vascular dilatation was secondary to this condition. Spiegelberg observed similar dilatation of the vessels in a gigantic tumor, which was probably a sarcoma.

Cysts occur not infrequently as in almost all other solid tumors. They develop in three ways: *viz.*, as softening cysts, with fatty, soft pulpy contents, and also as true cysts with a special, smooth wall. The latter are to be interpreted as dropsical follicles, which have been left over despite the degeneration of the tissues. They may attain the size of a walnut and contain a clear, cloudy or bloody fluid. Finally, there are

cysts which result from dilatation of the lymph spaces or vessels, are present in large numbers, and may almost give rise to fluctuation (fibroma lymphangiectodes).

Spiegelberg and Leopold maintain that ovarian fibromata are always pure fibromata, and that, in tumors with the characteristics of myo-fibromata, some mistake has been made with regard to the starting-point of the neoplasm. It must be acknowledged that this may be true of individual cases, since subserous uterine myomata often develop intra-ligamentary, may even separate entirely from the uterus, and thus assume a position which gives rise to error. But almost all pathologists, including Virchow, Klebs, Klob, Birch-Hirschfeld, believe that muscular fibres occur occasionally in ovarian fibromata. On account of the small number of muscular elements these tumors should rather be termed myo-fibromata.

Sangalli seems to have been the only one to observe a pure myoma of the ovary.

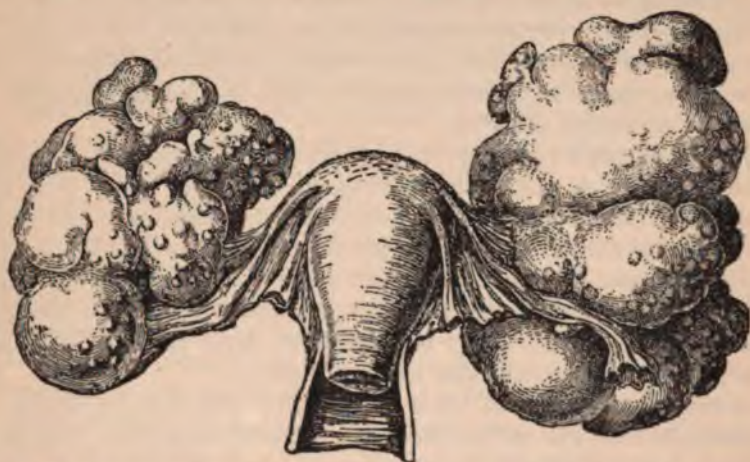


FIG. 35.--FIBROMA OF BOTH OVARIES, AFTER CULLINGWORTH. (Probably mixed sarcoma.)

He found a soft, vascular ovarian tumor, as large as a small hen's egg, composed in great part of muscular fibres, between which round cells were situated.

Apart from the previously mentioned softening cysts, the most frequent secondary change in fibromata is calcification of the centre or surface of the tumor, such as is found so often in uterine myomata. Other changes are rarer.

Waldeyer describes a peculiar kind of tumor, weighing 910 gr., which was removed by Spiegelberg. Its diameters were $15 \times 11 \times 10$ cm. The surface showed numerous tendinous thickenings, and in one place a round mass of cysts, as large as an apple, with serous, slightly bloody contents. The inner surface of the cysts contained short, cylindrical epithelium, the sole remains of the epithelial constituents of the ovary. The tumor, which could be cut with extreme difficulty, was composed of

a framework of sclerosed connective-tissue bands, after the manner of an osteoid tumor. The arrangement of the cells also resembled that of bone corpuscles, but there was no deposit of lime salts. The interstices of the framework were filled by a vascular tissue with wide lacunar blood spaces. In this case the tumor seems to have been on the way to ossification; in Kleinwächter's case, this change really seems to have taken place. The ovary was 10 cm. in length and breadth; a small portion was fibroma, the greater part was bone. Loebl also mentions an ossified ovarian fibroid, as large as a child's head, which was found in Rokitansky's Pathological Museum.

A peculiar variety of fibroma, which develops from the corpus luteum, was first described by Rokitansky.

It is characterized by the round shape, distinct separation from the remaining tissue, and, according to Klob, by the reddish yellow, often dentated cortical layer, the retained follicle membrane. It incloses the fibrous central mass, within which a cavity, containing brownish, iron-containing pigment and cholestearin, is found as the last remains of the former extravasation of blood.

In Rokitansky's two cases, which occurred in women of forty-three and forty-five years, the tumors were small, the larger one a little more than the size of a walnut. Klob describes one as large as a child's head. The somewhat flabby, because oedematous tumor, contained old and young connective tissue. The periphery was formed of a yellow layer 3" in thickness, which consisted of finely fibrillar connective tissue with numerous granular cells. Klob regards the peripheral layer as the follicle membrane, but Leopold thinks that this is not proven.

According to Patenko these tumors may also develop from non-ruptured follicles, and in this event do not contain a cavity. The coalescence of many corpora fibrosa may form a tumor of the size of a hen's egg, but they never attain a larger size.

Concerning the clinical history of fibromata, very little is to be added to the general remarks made on page 363.

Fibromata, as a rule, are unilateral. According to Leopold, there are three bilateral to thirteen unilateral tumors.

A notable feature is the comparatively frequent occurrence in young people. Leopold's tables mention thirteen patients between five to thirty years, and four between thirty and forty years. Among my six cases, one was twenty years old, and one twenty-five years, but there was also a patient of seventy years. Williams's patient was only eighteen years old. Few tumors attain clinical significance, because they remain so small. Tumors larger than a fist are rare. Cruveilhier reports a fibroma of forty-six pounds, J. Simpson one of fifty-six pounds, and Spiegelberg one of sixty pounds, but the purely fibrous character of these growths is doubtful.

The factor which most frequently affects the general condition and induces the patient to seek medical aid, is the complicating ascites, which appears early, and is often considerable in amount. As a rule, the cause of ascites is obscure in such cases. The fluid is clear and the peritoneum is found free from inflammatory appearances. Hence we cannot speak of inflammatory irritation, as occurs so often in the ascites complicating carcinoma. We are also unable to see how the usually small and slowly growing tumor should produce stasis and thus ascites, while this rarely occurs in the much more rapidly growing cystomata. Yet there is no doubt that the presence of the tumor alone gives rise to the ascites, since the latter always disappears with the extirpation of the former. In very rare cases marked ascites develops in cystomata, and then likewise its cause remains obscure. Thus, I removed a tumor as large as a head, and hardly weighing 2 kilo., which felt like a solid tumor in the ascites. It proved to be a proliferating cystoma without any large cavities. Nine days before evacuation forty-five pounds of clear, light yellow ascitic fluid had been removed, and two days before the operation the puncture wound burst open and discharged ten to fifteen pounds; in addition, seven pounds of fluid were removed during the operation. The ascites did not return after extirpation of the non-adherent tumor.

It is probable in such cases that the tumor stimulates the adjacent peritoneum to increased secretion, while the absorptive capacity of the latter is not increased in the same degree. But this does not explain the nature of the process. However, ascites is exceptional in fibromata, and for this reason the majority of ovarian fibromata are found accidentally on autopsy. Very few require clinical treatment. Thus, Spencer Wells removed only two fibromata in 500 ovariectomies. Ascites was present in both cases. The tumors weighed only 180 gr. and four and a half pounds respectively. Kiljour mentions a case in which a woman with a solid ovarian tumor was punctured forty-three times.

The growth of fibromata is very slow, probably even much slower than would appear from the statements of the patients, inasmuch as the early stages always run a latent course.

They rarely give rise to inflammatory conditions of the peritoneum. In Van Buren's case fatal peritonitis resulted from torsion of the pedicle.

A few cases of suppuration of the tumors have been reported. Rokitansky found an ichorous tumor, as large as a goose-egg, in the recto-uterine cavity of a puerperal woman. The gangrene had produced perforation of the vaginal fornix, a cold abscess which extended to the trochanter minor and purulent peritonitis; an hepatic abscess was also found. In view of the position of the tumor in the pelvis, compression during delivery is to be regarded as the cause of the suppuration. That an obstacle to delivery may be produced by a fibroma in this situation is shown by Kleinwächter's case. He performed Cesarean section on ac-

count of a fibroma (10 cm. in length and breadth) which was almost entirely ossified. Kiwisch and Safford Lee also mention suppuration of fibromata, but the cause is not evident from their brief mention of the cases.

The diagnosis of ovarian fibroma can only be made with regard to the origin of the tumor from the ovary. Certainty as regards its histological character can only be obtained after extirpation. But the diagnosis of a solid growth may also be attended with difficulty. As a matter of course we must determine the pedunculation of the tumor to one horn of the uterus, by all the exploratory means which have been described in the discussion of cystomata. If the tumor is undoubtedly solid, the suspicion of pedunculated uterine myoma will sometimes arise. In such an event we will rarely be able to feel the unenlarged ovary, and to recognize it as such. As a matter of fact, solid ovarian tumors (fibroma and sarcoma) have often been mistaken for uterine myomata.

Even when the tumor is recognized as ovarian, it is not always regarded as solid. Small cystomata (dermoid or parvilocular proliferating cysts) often feel perfectly solid, and in doubtful cases we will often, on account of the rarity of solid tumors, make a diagnosis of cystoma. The opposite error is made more frequently, *i.e.*, a parvilocular cystoma is mistaken for a solid tumor.

If, on account of the favorable condition of the abdominal wall, etc., the diagnosis of a solid, ovarian tumor is assured, we may suspect a fibroma from the good general condition, the small size of the unilateral tumor, the absence of ascites, and especially from demonstrable lamellar calcification of the tumor; the opposite conditions make the diagnosis of sarcoma more probable.

The treatment consists simply of extirpation. This is indicated forthwith in every larger tumor, on account of the uncertainty whether we have to deal with a fibroma or sarcoma; the indication is most imperative when ascites is present. Solid ovarian tumors require a comparatively long abdominal incision, because they must be removed without being diminished in size. In other respects the same rules hold good as in the operation for cystomata.

OVARIAN SARCOMA.

Spindle-cell sarcoma is the most frequent form of ovarian sarcoma, but softer forms, which contain many round cells, also occur, while pure round-cell sarcoma is extremely rare. Virchow says "true sarcomata (of the ovary) form, as a rule, solid tumors with a tolerably uniform surface, so that, at the first glance, they look like simple hypertrophies. On section they have a dense, reddish white or pure white, radially streaked appearance. The consistence may be firm or loose, sometimes so loose

that they can be torn into radiating bands or bundles." The round or oval tumor may attain the size of a child's head or more. The tumor generally contains cysts, which are usually not large and do not project much above the surface of the tumor.

The tissue of these fibro-sarcomata consists of crossing bundles of spindle cells, such as, according to His, the ovarian stroma is composed of. Leopold, who showed that ovarian sarcoma is more common than has been hitherto supposed, believes that the structure of the normal stroma favors the development of sarcomatous tumors of the ovary, and Klebs also regards the tissue of ovarian sarcoma as an hyperplasia of the mother tissue. Numerous vessels, in part with very wide lumina, run within the bundles of spindle cells. According to Waldeyer and Klebs the walls of some of the vessels consist only of endothelium, and these writers regard the bundles of spindle cells essentially as hyperplastic vessel walls. Leopold does not coincide in this opinion, as he never failed to find the walls of the vessels.

In some sarcomata numerous round cells are found between the bundles of spindle cells, and in part are mixed with the latter. In many cases only certain portions of a tumor contain round cells. Where they are present in larger numbers, the tumor may resemble medullary sarcoma. Beigel and Albert have described pure round-cell sarcoma of the ovary.

Leopold also mentions proliferations of sarcoma tissue on the outer surface of the ovary. They appear as broad masses of connective tissue, infiltrated with spindle cells; their external endothelial covering is sharply defined from the germinal epithelium, where the latter is retained on the intact portions of the ovary. Leopold compares these proliferations with the papillary proliferations described by Slavjansky in oöphoritis.

Fibro-sarcomata not alone are allied to fibromata—in some cases they appear to start from originally pure fibromata—but they may also approximate malignant growths, adenoma and carcinoma.

Leopold has recently investigated the mode of development of adeno-sarcoma. He examined the conditions of the follicles and corpora lutea in fibro-sarcoma, and found both intact at the beginning of the tumor-formation. But later the corpora lutea and the smaller follicles become infiltrated with spindle cells, and the entire follicle is converted into sarcoma. The larger follicles, on the other hand, are dilated, while their ovula are destroyed; they form groups of cavities which are lined with a single layer of cylindrical epithelium. These remains of the glandular tissue are situated in great part below the surface, not in the interior. Leopold also found glandular structures, which were derived from the follicles, at the hilus of the ovary. This form of tumor probably includes the cysto-sarcoma ovarii uterinum, which was described by Rokitsansky. Ackermann's examination of the tumors extirpated by me has

confirmed the frequency of adenomatous structures even in large sarcomata.

Transitions to carcinoma,—sarcoma carcinomatosum,—are also seen. Thus, Spiegelberg observed a bilateral tumor which he called myxosarcoma carcinomatosum hæmorrhagicum. One ovary was $20 \times 12 \times 4$ cm. in size, the other $15 \times 10 \times 4$ cm. Both tumors consisted, in the main, of round-cell sarcoma. Certain parts, which had a whitish yellow appearance in places, contained large alveoli with partly fatty large cells and a vascular connective-tissue framework, which presented the appearances of carcinoma. The tumors also contained hemorrhages, which, in one place, had given rise to destruction and rupture of the tumor into the abdominal cavity and fatal peritonitis.

Klebs has emphasized the difficulty of determining the pathological character of such tumors. According to him the epithelium is often found in the shape of small groups of round cells, which may be mistaken, at first, for lymphoid corpuscles. "Careful examination alone reveals certain characteristics which testify to their epithelial origin, the large clear nucleus with a large nucleolus, and a narrow zone of cell substance, often of an angular shape."

Leopold described a very peculiar tumor in a child of eight years. It was a sarcoma with cystic spaces, which contained in part cylindrical epithelium, in part cells arranged in lamellæ-like pearly bodies, and finally, numerous endothelial masses. The latter were derived from the lymph vessels, and had perforated into the glandular cavities, so that endothelial and epithelial cells were situated alongside of another in the same cavity. Leopold called this tumor lymphangioma kystomatosum.

Fatty degeneration, which is directly connected with formation of cysts, is one of the most frequent metamorphoses in sarcoma. In some parts of the tumor the spindle and round cells undergo fatty degeneration, accumulations of a mucous fluid forming between the bundles of tissues. An oedematous appearance of the part is thus presented. At first yellow points and streaks appear, later the entire part assumes a deep yellow color. We thus find parts as large as a walnut or even a small fist in a condition of fatty degeneration. Finally, a softening cyst is produced without walls, and with cloudy, fatty contents. This process is so common that there are few sarcomata which do not contain one or more softening cysts. Koeberlé has, therefore, said that he has never seen an absolutely solid ovarian tumor.

Other processes possess greater practical importance, for example, thromboses which develop occasionally in the larger veins around the fatty foci. They may terminate in destruction of the thrombi and embolic processes, or in hemorrhages into the tumors, necrobiosis, rupture and peritonitis.

The greatest significance attaches to metastases, which are observed

not very rarely. They affect most frequently the stomach, also the intestines and peritoneum, and occasionally the pleura. The lymphatics always escape.

Pure spindle-cell sarcomata exhibit the least tendency to metastases; next come the round-cell sarcomata, while, according to Klebs, adenocarcinoma has the greatest tendency to the development of metastases. Leopold states that diffuse metastases always occur in bilateral ovarian sarcoma, and this makes it indirectly probable that the ovarian disease is primary. But metastases also occur in unilateral tumors. Thus, on autopsy after extirpation of a unilateral tumor, I found sarcomatosis of the peritoneum and pleura, and a sarcoma as large as a hen's egg in the uterine cavity.

A comparatively large proportion of the cases occur at a youthful age, and even childhood does not escape. Klebs says that the tumors are even found in the new-born, and may attain a considerable size.

Among thirty-seven cases which I have collected, five were below the age of twenty years, nine between twenty to thirty years, eighteen between thirty to forty years, and four between fifty-eight to sixty-seven years.

Among Leopold's twelve cases, seven were bilateral. There was only one bilateral tumor among my fourteen cases.

The cause and duration of the disease vary considerably. Some cases terminate in a few months. In three of Leopold's cases the duration seems to have been three to six months, while in Clemens' case the tumor was present ten years, and its growth was not rapid until the last; it finally weighed eighty pounds. In the absence of all statements regarding the microscopical appearances, however, it is doubtful whether this was really a case of sarcoma. In one undoubted case of cysto-sarcoma, however, I observed a duration of nine years. We cannot look upon a rapid course as the rule, although it occurs in individual cases.

The complicating ascites has a marked influence on the course of the disease, and often gives rise to the first symptoms. It is sometimes very slight, in other cases very considerable.

As a general thing, the tumors, especially when they are bilateral, do not attain a large size, but in other cases they grow to colossal dimensions. In the case already reported, the patient lived for several years with a tumor which far exceeded the dimensions of the uterus at full term; after death it was found to weigh twenty-five pounds, although twenty-two pounds of fluid had been evacuated not long before. But this was a cysto-sarcoma of the most exquisite kind. Tumors which are, in the main, solid, very rarely attain such dimensions. In the majority the size varies from that of a child's fist to that of a man's head.

Death usually results from marasmus, which accelerates the complicating ascites or the metastases. It occasionally follows peritonitis, pleurisy or embolism of the pulmonary artery.

I will here give a brief *resumé* of the cases upon which I have operated:

1. Mrs. S., aged twenty-seven years, married two years, sterile. Since spring of 1875, tenderness of abdomen. Since summer of 1875, perceptible abdominal tumor, weakness, cessation of menses, fever, great pain in abdomen. Return of menstruation after interval of three months. In May, 1876, I found a smooth almost spherical tumor as large as the uterus in seventh month of pregnancy; consistence of a fibroma, great mobility, moderate ascites, umbilical hernia, uterus retroverted. Ovariectomy on May 16th, 1876. Tumor free with exception of an omental adhesion. Pedicle long and thick; ligated with catgut and replaced. Left ovary enlarged four-fold by a simple cyst, and is also extirpated. Drainage through Douglas's sac. Six months after operation patient reports herself well.

The tumor contained only two small softening cysts, otherwise solid; proved to be spindle-cell sarcoma with a few round cells.

2. Mrs. O., aged fifty-one years, menses ceased six years ago; seven children. Abdominal tumor noticed for three months; weakness. Abdomen contains a spherical, extremely firm, painless tumor, as large as uterus in fifth month of pregnancy; freely movable in ascites; uterus retroverted. Ovariectomy, May 26th, 1876. Long incision; no adhesions; pedicle very short and thick, applied to left horn of uterus. At the pedicle the tumor begins with a round portion, as thick as a thumb, which passes into the tumor proper by means of a short constriction. Ligature applied exactly at boundary between the very short pedicle and the tumor. Removal within the button-shaped portion of the tumor. Right ovary healthy. Drainage through the vagina. Recovery. Patient well at end of a year. The tumor is 17x15x9 cm. large, the posterior surface smooth; two softening cysts, one with a trabecular inner wall, the other with perfectly smooth inner surface without epithelial lining. The tumor contains firmer and softer parts, the former permeating the entire growth like a network. It consists of long spindle cells, through which pass bands of firm connective tissue.

3. Mrs. A., aged thirty-one years; had her only child in 1872; protracted illness during the puerperal state. Almost constant metrorrhagia for next two and one half years. Amenorrhœa since July, 1875. In November, 1876, found a very movable tumor, extending from pelvis to just above the umbilicus; it was floating in ascitic fluid; consistence appeared tense elastic. Tumor larger transversely, with many smaller prominences and a large appendage. Uterus elevated and retroverted behind the tumor. Pedicle felt per rectum, extending to right border of uterus.

Ovariectomy, November 8th, 1876. Evacuation of one litre fluid after puncture of an elastic part; severe hemorrhage after removal of trocar. Omental adhesions, one including a large part of the omentum. The quite narrow pedicle and omental adhesions were ligated with catgut. Left ovary small and firm. No drainage. Recovery, complicated by double croupous pneumonia. The tumor weighed 1875 grm. A number of softening cysts and many hemorrhagic infiltrations of the tissues appeared on section. The large appendix of the main tumor proved to be the ovary, which was as large as a hen's egg and closely applied to the large tumor. The ovary is infiltrated with a number of sarcoma nodules. Hence, the main tumor has grown from the surface of the ovary. The tumor is a round-cell sarcoma.

Three months later patient appeared with a very movable tumor, 15 cm. long, in the left hypochondrium. Three months later this had doubled in size (metastasis of the omentum).

4. Miss L., aged nineteen years. Tumor almost as large as a man's head, with smooth surface. Operation showed pedunculated myxosarcoma, starting from surface of ovary. Pedicle twisted one and one half times. Tumor weighed 2 kilo.; death from sepsis on seventh day.

5. Mrs. S., aged forty-nine years; cysto-sarcoma of moderate size, pelvic adhesions. Ligatures *en masse* in pelvis. Pedicle ligated with catgut. Thymol irrigation of abdominal cavity followed at once by shock and death in twelve hours. Sarcoma of peritoneum, pleura, and inner surface of fundus uteri.

6. Mrs. B., aged thirty-nine years; solid tumor, as large as a man's head, with abundant ascites. Pedicle ligated in two halves with catgut. Tumor proved to be myxosarcoma. Recovery.

7. Miss P., aged twenty years, tumor of left side, as large as child's head, slight ascites. Ovariectomy. Tumor situated on ovary (development from its surface). The very firm tumor had a yellowish medullary appearance on section.

8. Mrs. M., aged thirty-three years. Bilateral solid ovarian tumor, no ascites, omental adhesions, surface adhesions in pelvis: the tumor on right side is partly subserous. Four elastic and four silk ligatures were applied. Recovery. Tumors consisted of extensive, quite vascular stroma, composed of large spindle and stellate cells, also a few larger round cells; in other places the structure has more of a fibromatous character. The stroma throughout is infiltrated by quite numerous epithelial tubes and strands, which consist mainly of low cylindrical epithelium and do not appear to anastomose with one another. No distinct cystic formations.

9. Miss M., aged twenty-one years; extreme emaciation after pleurisy; abdominal tumor as large as a man's head. Operation showed a right-sided, non-adherent, very brittle tumor. Other ovary small and firm. Pedicle tied with elastic and silk ligature. Recovery. Tumor was an almost pure spindle-cell sarcoma, with tolerably large cells.

10. Mrs. B., aged fifty-eight years. Tumor weighing ten pounds, partly elastic; severe hemorrhage on puncture, so that point of puncture is closed with sutures. Intestine adherent for a distance of one meter. Difficult separation of enormously vascular mesentery; ligatures *en masse* to latter. Hemorrhage from a rent in broad ligament. Severe collapse. Death five hours after operation. The tumor was a cysto-sarcoma.

11. Miss B., aged twenty-five years. Solid tumor of right ovary, half the size of a fist; on section has a medullary appearance, with numerous calcareous concretions. Outer surface extremely nodular. No adhesions or ascites. On account of shortness of pedicle, it was necessary to enucleate the base of tumor somewhat, in order to secure sufficient tissue for ligaturing. Uninterrupted recovery.

12. Patient aged twenty-three years. Solid tumor (three pounds) of left ovary; some ascites; parietal, omental and intestinal adhesions. A quite broad, sufficiently long pedicle. Right ovary healthy. The tumor is a mixed sarcoma. It shows a fibrous stroma, containing numerous heaps of larger round cells. These foci pass insensibly into adjacent tissues (not carcinoma). There are also many round cells scattered irregularly in the stroma outside of these foci. No gland tubules found. The structure of the tumor, therefore, was in some places that of a fibroma or fibro-sarcoma, in other places that of a large-celled round-cell sarcoma. It contained three or four softening cysts. Patient recovered.

13. Mrs. W., aged sixty-seven years. Sarcoma of right ovary, weighing 10 kilo., with many large softening cysts. No ascites; several intestinal adhesions. Pedicle short, thick, moderately broad. The tumor had a very irregular shape.

A part as large as a child's head was situated in Douglas' sac. The microscope showed a large-celled spindle-cell sarcoma. Patient recovered without reaction.

My 14th case, described on page 162, was a large cysto-sarcoma.

On a review of the cases we are struck by the frequency of ascites (in six cases) and by the rarity of adhesions, which are usually absent or inconsiderable even when ascites is absent. The majority of the tumors were spindle-cell sarcomata. Cases 4 and 6 were myxo-sarcoma, Case 3 a round cell sarcoma. In the latter a metastasis rapidly formed. Metastases were found at the operation in Case 5 alone, the only bilateral tumor (Case 8) was a spindle-cell sarcoma.

The pedicle was usually short, but rarely presented the structure described by Leopold as characteristic of solid tumors. Torsion of the pedicle was found once. The bilateral tumor was partially subserous.

There were three deaths among the thirteen operations, one from sepsis on the fourth day, two from shock on the first day.

On the whole, sarcoma of the ovary is comparatively little malignant, rarely is attended with metastases, and, as it appears, is not often bilateral. The malignancy is manifested more by the often very striking affection of the general condition. Amenorrhœa sets in early and the patients are very feeble, but recover rapidly after extirpation of the tumor. They are far inferior in malignancy proper to carcinoma of the ovary and also to papillary cystomata. The latter, however, often contain cancerous parts.

The diagnosis of ovarian sarcoma is based essentially on the same conditions as fibroma. If the diagnosis of ovarian tumor is undoubted, sarcoma is most apt to be mistaken for fibroma, but also for carcinoma and proliferating cystoma.

Inasmuch as large fibromata, which give rise to clinical symptoms, are much rarer than sarcoma, the latter diagnosis is more probable in doubtful cases. Ascites and rapid growth will increase this suspicion.

An exquisitely nodular character of the tumor, peritonitic symptoms and notable cachexia favor the diagnosis of carcinoma; the strongest point in favor of the latter is immobility of the tumor, especially if ascites is present. Youthful age does not disprove carcinoma. When a proliferating cystoma forms only a small tumor without large cavities and with ascites, the diagnosis is as impossible as in those cases in which the sarcoma becomes cystic (Case 3). If an exploratory puncture should furnish a spontaneously coagulating fluid (as in the case mentioned on page 162) in cysto-sarcoma, instead of a fluid containing mucin and paralbumin, we may be led to form a correct diagnosis.

The treatment consists solely of extirpation. In the majority of cases this seems to have effected a radical cure, and the danger of relapse is not very great. Extirpation is usually unattended with special difficulty, although the solid tumor requires a relatively long abdominal incision.

Enchondroma of the ovary is so rare that only two cases have been reported. One was described by Kiwisch. The tumor was as large as a fist, surrounded by numerous false membranes; externally it presented numerous hard cartilaginous masses which, on section, diminished in hardness internally and there had the structure of hyaline cartilage.

According to Scanzoni a second case, which Kiwisch describes as enchondroma, was a fibroid of both ovaries, on whose outer surface numerous cartilaginous plates had formed. Schroeder recently extirpated a tumor, weighing 1500 grm., which proved to be a fibroma containing numerous cartilaginous islets; bone was also present.

CARCINOMA OF THE OVARY.

Carcinoma develops quite often in the ovary, if we include all the mixed tumors which contain carcinoma. But those tumors which consist principally of carcinoma are even less frequent than dermoids and sarcomas.

Cancer of the ovary appears as scirrhus, medullary and colloid cancer, and not infrequently in the papillary form. It is especially frequent in combination with almost all other forms of neoplasm, most frequently with papillary and glandular cystoma, not very rarely with dermoid cysts. It is much more often primary than secondary.

Winckel describes two cases of secondary carcinoma of the ovary. In one case there were three cancerous nodules from the size of a pin's head to that of a pea upon the surface of one ovary, together with larger nodules on the outer surface of the tube and the fundus uteri. The second case is more convincing. One year and seven months after galvano-caustic removal of a cancerous portio vaginalis nodules of cancer were found in the ovary, pelvic bones and pelvic cellular tissue, while there was no relapse at the primary site of the tumor. The left ovary was converted into a fluctuating tumor as large as a child's head, which was carcinomatous throughout. The right ovary, which also contained a dermoid cyst, was entirely surrounded by large cancer nodules.

Cancer of the ovary is not infrequently bilateral. Among Leopold's twenty-three cases ten were bilateral; among forty additional cases twenty-three were bilateral.

Medullary carcinoma is observed most frequently, partly as an independent disease of the organ, partly as a complication of previous cystic degeneration. If there has been no pre-existing cystoma the carcinoma, which is generally primary, involves the entire ovary uniformly. There is carcinomatous degeneration of the entire stroma, portions of the parenchyma being still intact at the start, until finally all the follicles are destroyed by the pressure of the epithelial proliferations. But the occurrence of pregnancy in advanced carcinomatous degeneration of both

ovaries proves that a long time often elapses before all the follicles are destroyed or made incapable of function.

Medullary cancer forms tumors up to the size of a man's head, which either retain the approximate shape of the ovary, or, as in almost all my cases, become spherical. The surface is usually distinctly nodular and has a marbled appearance.

Both ovaries are attacked most frequently by the fibrous form of cancer. Klebs says, "the absence of a nodular surface alone distinguished the cases which I have seen from congenital fibroma of the ovaries; otherwise the firmness and fibrous structure were identical." These scirrhus tumors do not, as a rule, grow larger than the fist.

If the cancer has developed in a cystic ovary, it does not always present the same character in different places. While some parts have the pure structure of proliferating cystoma, others show the development of carcinoma more or less distinctly. The cancerous parts are either entirely enclosed in the connective-tissue walls of the tumor, or they project into the cavities and may even fill the smaller cavities completely. It is best to apply the term *cystoma carcinomatosum* to such cases. In others the glandular and cancerous formations are so intermingled and the structure of glandular cystoma has dropped so much into the background, that it is more correct to speak of glandular carcinoma, especially when the secondary tumors contain, as Klebs showed, glandular tubules.

Klebs also called attention to the fact that this form of carcinoma may appear in the cicatrix or on the peritoneum after the extirpation of apparently pure cystomata.

Most closely allied to these cases are those described as colloid or alveolar carcinoma. The entire ovary is enlarged to the size of a fist or even of a man's head, and on section presents the microscopic appearances of a parvilocular cystoma. The cavities, which are as large as a pea and even much smaller, contain colloid masses; the stroma contains nests of epithelial cells imbedded in the remains of the ovarian parenchyma.

These tumors, which are classed by some among the cancers, by others among the cystomata, are regarded by Waldeyer as a transition stage which can not be kept entirely distinct either from the cystomata or carcinomata.

According to Rokitsky colloid cancer is usually combined with medullary cancer, and often appears symmetrically in both ovaries, usually at an advanced age. The peritoneum often contains secondary proliferations of medullary cancer.

Papillary cancer of the ovary is a peculiar form of the disease. A tumor which is, in the main, a proliferating cystoma, contains papillary formations that are found, on careful examination, to possess the structure of carcinoma. In addition there may be larger medullary nodules.

Klebs and Spencer Wells first called attention to this form of disease.

The former suspects that it includes certain forms of medullary cancer, in which the ovaries are replaced by extremely soft tumors, consisting of fibres and a milky pulp, and which are usually associated with diffuse carcinosis of the peritoneum. Klebs includes in this category the previously mentioned case, in which Beigel, eighteen months after a bilateral ovariectomy by Baker Brown, found a large papillary tumor of the peritoneum.

Eight years ago I suggested that the papillary form of carcinoma may be concealed more often in proliferating cystoma, that a number of exquisitely papillary cystomata should be included among carcinomata, and that so-called papillary carcinoma is not so rare as Klebs believed. This opinion has been verified, and I here report a case of this kind:

Mrs. H., aged twenty-four years, married seven years, sterile; during first year of marriage had abnormally long and unequal menstrual intervals; subsequently menstruated regularly. In May, 1876, peritonitic pains began and she was confined to bed for several weeks. The inflammation developed gradually and was treated with ice compresses. When I first saw the patient, a few months later, symptoms of inflammatory irritation in left side of pelvis still present. A tender tumor, as large as a fist, was felt there and appeared to be situated in the broad ligament. The slightly displaced, not enlarged, uterus was very little movable and lay to the right of the tumor. Ten weeks later, the condition was entirely changed. The abdomen contained a considerable amount of free fluid and was as large as towards the end of pregnancy. Diuresis scanty, menstruation delayed and attended with pain, body emaciated, obstinate constipation, gastric disturbances after each meal. No œdema, no fever.

Uterus now anteverted, and behind it, in the left posterior segment of the pelvis, could be felt, by passing half the hand into the rectum, an elastic tumor as large as a fist, which was continuous with the uterus by a broad portion. The tumor appeared to be immovable on the floor of the pelvis.

Two punctures (end of 1876 and beginning of 1877) discharged considerable amounts of ascitic fluid and the tumor could be felt after each evacuation.

The diagnosis hesitated between cancer and papillary cystoma of the ovary.

After marked reaccumulation an exploratory incision was made ten weeks after the second puncture, in order that the only hope of recovery might not be neglected. After the escape of 18 kilo. light yellow, clear ascitic fluid, the tumor, which was as large as two fists, was seen with its lower half entirely between the layers of the broad ligament and closely applied to the sacrum; anteriorly and on the right side it was so adherent to the bladder that the boundary between the two parts could not be recognized. The tumor was entirely immovable. Its bluish white surface was smooth and projected in one place with the main cyst. This was incised and discharged colloid masses; it was lined internally with papillomata. On the right side was felt a tumor of the size of a small apple; this was also intra-ligamentary and destitute of a pedicle.

Extirpation was not performed. Before closing the abdominal wound, an omental band, which adhered to the pelvic tumor on the left side and was covered with peculiar warty growths, was partly excised after double ligature.

The incision was not followed by general or local reaction. The patient improved, but the ascites returned, although more slowly than before. At the end of fourteen weeks puncture again became necessary and evacuated 15 kilo. fluid,

Marchand examined the excised portion of omentum with the following results:

The band contained numerous nodules or villi as large as the head of a pin, and a soft, grayish-red nodule as large as a hazel-nut. The illustrations are taken from the latter. On teasing, numerous shining concretions, the majority of which were spherical, appeared; many of them had coalesced with one another. The concretions were situated within cellular masses.

The larger nodule showed soft, connective-tissue stroma with numerous, in places, densely aggregated spindle and round cells; the concretions were situated in these cell masses.

The tissue contained a few large, round cells with one or more nuclei. They were situated in a sort of crevice in the tissues, and were very different from the smaller cells of the basement substance (Fig. 36, 1 and 6). In other places a num-

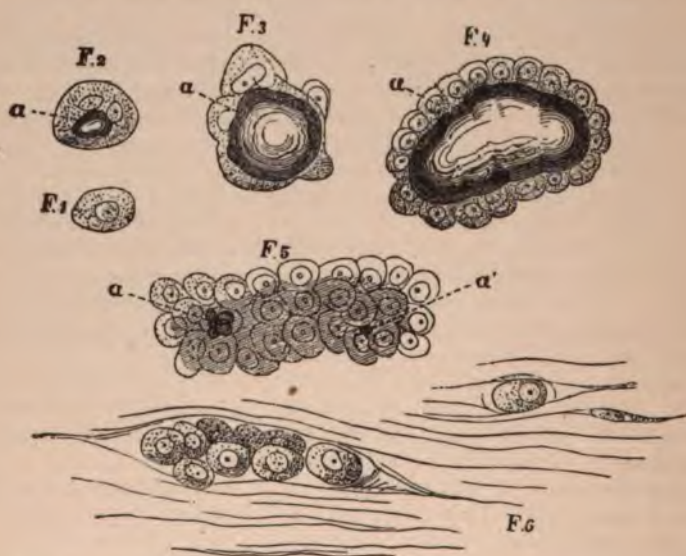


FIG. 36.—CONSTITUENTS OF A PSAMMOMATOUS, PAPILLARY, CYSTIC CARCINOMA OF THE OVARY.

ber of these cells were accumulated; finally, there were larger cell tubules or irregular club-shaped formations, whose structure presented the greatest similarity to epithelial formations. They were situated quite loosely in the meshes of the tissue and were readily set free on teasing.

The development of the concretions could be easily traced. A few of the round cells contained a small shining body (2a), concerning which it remained doubtful whether it had developed in the finely granular cell protoplasm itself or in connection with the nucleus. The enlargement of the concretion went hand in hand with enlargement of the cells, in which several nuclei made their appearance. Finally, large, elongated or round concretions (4) were found, surrounded by a cell mantle.

The concretions were so numerous and large that they formed a large part of the tumor, which resembled a psammoma in this respect. There were also large cell tubules, some of which contained concretions (5) while others did not. The

concretions consisted of carbonate of lime with an organic basis which, after treatment with acids, appeared as a concentrically laminated structure with a centre like a nucleus. The inorganic substance slowly dissolved in acetic acid, without any distinct development of gas; the latter was very marked on the addition of concentrated sulphuric acid. Numerous needles of sulphate of lime formed at the same time.

The small nodules on the omentum have a narrow pedicle, and their top is formed of a large number of branching villi which terminate in round ends. These are covered with a single layer of low cylindrical epithelium; they possess a thin, nucleated membrane, which encloses cellular structures. In the smaller villi the latter look like the above-described round cells or the epithelial groups of cells. In the larger villi, which contain wide, thin-walled vessels, they look like loosely aggregated pavement epithelium, which fill the space between the wall of the villus and the vessels.

Marchand adds: "although these structures possess certain peculiarities which resemble those of sarcoma, nevertheless Klebs's opinion that it is a papillary ovarian carcinoma, based on the great resemblance of the essential elements to true epithelium, seems to be correct. In this event the tumor should be called a psammomatous, papillary, cystic carcinoma of the ovary."

This case also possesses clinical interest on account of the youthful age of the patient, the onset of the disease with inflammatory symptoms, the relatively good condition of the patient after prolonged duration of the disease.

Flaischlen has reported a similar case. The patient was twenty-six years old. The tumor had pressed the floor of Douglas's sac forcibly towards the lumen of the vagina. Death occurred a year after the case first came under observation. Flaischlen distinctly demonstrated the development of the psammomatous bodies from heaps of epithelial cells. In another case this author found some papillomata of a papillary cylindrical epithelium cystoma in the beginning stage of cancerous degeneration. The wall, upon which the papillomata were situated, was intact. Numerous corpora arenacea were situated in the epithelial spaces and the stroma of the papillæ. The tumor was unilateral and not intra-ligamentary. It looked like an ordinary cystoma, and its anatomical structure and clinical significance were only revealed by the microscope.

A similar condition is observed in many ovarian tumors. Among 102 tumors extirpated by Schroeder and examined by Flaischlen there were four glandular, two papillary and one dermoid cystomata, which exhibited cancerous degeneration.

Rokitansky describes one case of carcinoma as a development from a corpus luteum. The tumor, in a woman of sixty-nine years, was as large as a child's head, and had a convoluted, whitish red cortical mass, eight to twelve lines in thickness. Within lay a whitish mass of connective tissue, infiltrated with sticky serum, and sending septa into the cortical substance. Externally it was covered with a white layer of connective tissue, which contained numerous, follicle-like,

larger and smaller cysts. This constituted the separated, hypertrophic ovarian tissues. The cortical mass consisted of a dense, fibrous stroma, whose interstices were filled by a medullary mass consisting of round, angular, caudate, and large mother cells.

An important feature in the clinical history of ovarian cancer is the fact that it often occurs at an early age, and may even develop during childhood. In 1873, I reported a case of cancer in a woman of twenty-three years. Since then I have observed it at the age of twenty-six, twenty-one, nineteen, twelve, eleven and eight years. In the majority of these cases the tumors were soft, medullary and bilateral. With the aid of Leopold's tables I have collated the following statistics:

Below 20 years (8-19) 10 patients.

20-29	"	17	"
30-39	"	8	"
40-49	"	15	"
50 years and above	17	"	"

The majority of the patients in the second decennium were not much above twenty years of age. Hence, puberty is an undoubted predisposing factor, and this is extremely important in diagnosis.

Other etiological factors are unknown. The number of previous parturitions appears to exert no influence, even in women at the age of forty to sixty years. One of my patients, who was attacked at the age of twenty-one years, had indulged in excessive sexual intercourse, but nothing is known concerning the occurrence of the disease in prostitutes.

The disease generally begins slowly, but in some cases the onset is quite acute and attended with inflammatory symptoms, as we sometimes see in proliferating cystoma. The cessation of the menses is not infrequently one of the earliest symptoms. In the later stages menstruation is almost always absent. Pains in the tumor often develop at a later period, but severe pains in the tumor itself are generally absent. Peritonitic irritations, on the other hand, are not uncommon, and give rise to pain temporarily or for a longer period.

The occurrence of ascites generally exerts a decided influence on the patient's condition and symptoms. Although the development of the tumor may have lasted months or even more, yet the ascites usually appears before the growth has attained any considerable size. Ascites occurs finally in the majority of cases, and in some becomes very pronounced. It rapidly returns after puncture. Oedema of one or both legs is much less frequent, but also occurs often at an early period. When it does not begin in the late stages of the disease, it depends generally on compression of the veins by the adherent tumor or by infiltrated lymphatic glands. A certain diagnostic value undoubtedly attaches to early oedema of the legs.

Not alone do some patients often feel quite well subjectively, especially if pain and ascites are absent, but the appearance of the patient may not indicate the gravity of the disease, and the physician should not be induced to abandon the diagnosis on account of the absence of a cachectic appearance. After the development of ascites, however, the majority of patients rapidly emaciate, and they look ten to fifteen years older than they really are.

The course and termination of the disease are as variable as its onset. There are cases in which only a few months elapse from the first symptoms until death, in others years elapse. In the former the severe course is evident at once from the exhaustion, rapidly increasing ascites and severe pains. The slow course of other cases is attended with great variations in the general condition, so that hope is long kept alive in the minds not only of the laity but even of the physician.

Death results usually from marasmus, occasionally from pulmonary embolism, peritonitis due to rupture of a cancer nodule into the abdominal cavity, pleurisy from secondary carcinoma of the lungs, or from complications on the part of the intestinal tract.

Secondary cancer is found most frequently in the retro-peritoneal glands, peritoneum, then in the stomach, intestines and liver.

Foerster found secondary nodules in the liver and spleen, Bixby on the peritoneum and diaphragmatic pleura; Hempel describes secondary cancer of the peritoneum and stomach and perforation of the latter. Spiegelberg found secondary nodules in the abdominal walls, Kuester in the integument of the navel, the peritoneum, uterus, lumbar glands and sternum; I observed metastases in the lungs, in another case in the liver, omentum and peritoneum; Hohl, in the mamma, pelvic bones and femur. Pajet observed the combination of the hard forms of cancer with scirrhus of the breast or stomach.

I will now give a brief sketch of a few of the cases which have come under my observation:

Miss E., aged nineteen years, unmarried, appearance almost that of a child; menses began at age of fifteen years, regular until beginning of April, 1867, then amenorrhœa until death (October 8th, 1867). August 1st patient came under my observation. Had been in bed two weeks, constant abdominal pain. Abdomen as large as in sixth month of pregnancy. A nodular tumor is felt, extending to the umbilicus; it is firm throughout, except in a few elastic places. The individual nodules, about ten in all, were as large as a fist. Tumor quite movable. Legs not œdematous.

Five weeks later the tumor had grown decidedly; it was almost fluctuating in places and tense. Ascites rapidly developed, and considerable exudation in right pleural cavity. Death occurred six months after appearance of first symptoms (amenorrhœa).

Autopsy showed bilateral hydrothorax, considerable ascites. Each lung contained a soft cancer nodule as large as a pea. Retro-peritoneal glands as large as walnuts and infiltrated. Tumor adherent to greater omentum and to parietal

peritoneum of abdominal walls on both sides. Here the cancer had extended to the abdominal walls themselves. Outer surface of tumor partly bluish red, partly whitish. Section partly medullary, partly cheesy, partly myxomatous. A few softening cysts on posterior surface of tumor. Microscope showed a cancer rich in cells. Unfortunately my notes say nothing concerning the other ovary.

Alwine C., aged twelve years, somewhat thin but looks healthy. Her mother noticed the abdomen enlarging for past four weeks; since then it has grown rapidly. In the median line is a tumor, extending above the umbilicus and disappearing below in the pelvis; it was firm or very tensely elastic, not tender, slightly movable, and contained numerous nodules.

The tumor soon grew rapidly, and then pains set in, with albuminuria, œdema of legs, and great feebleness. Death five months after first symptoms.

The attending physician gives following report of autopsy: tumor has nodular surface and very soft consistence; a number of intestinal adhesions; moderate purulent, peritonitic exudation. The tumor contained purulent and gangrenous parts; otherwise, the cut surface looked like medullary cancer. It had entirely destroyed the uterus and ovaries. Vagina, bladder, rectum, stomach and spleen healthy. Liver enlarged and contained some hemispherical projecting cancer nodules. Compression of left ureter by tumor.

The following case is extremely interesting from a clinical standpoint:

M. G., aged twenty-eight years at time of death; first menstruated at age of twenty years; bore children at age of twenty-two and twenty-four years. Three years after last child-birth, had attack of pelvic peritonitis and confined to bed for a month. Relapse after going out, so that attack lasted nine weeks. After recovery the abdomen was enlarged and remained so; constant abdominal pains but patient not prevented from working. I first saw patient November, 1871, one year after pelvic peritonitis; amenorrhœa for past year. Circumference of abdomen 100 cm; no tenderness on pressure; considerable ascites. Thrombi in varicose veins of right leg. From January to October, 1872, patient punctured eight times; fluid reddish or dark brown, and contained cylindrical epithelium. After the first puncture a tumor was felt behind the uterus as a nodular, firm, tender mass, situated in the median line. It appeared intimately adherent to uterus and posterior wall of pelvis. After the subsequent punctures two nodular tumors, as large as a child's head, could be felt from the outside: they covered the entrance to the pelvis symmetrically.

After the last puncture, the tumor on the left side had grown almost to the false ribs. Œdema of the legs had been present for months. November 7th (twelve days after last puncture) death occurred from embolism of pulmonary artery. Autopsy: considerable bloody ascites; parietal peritoneum opaque and thickened, and containing a tumor, as large as a goose-egg, with a grayish, white cut surface and quite firm consistence, and numerous small tumors, as large as a hazel nut. Great omentum converted into nodular mass. Large amount of clear fluid in right pleural cavity; extensive eruption of firm, gray miliary nodules on pulmonary pleura. Right lung compressed and carnified; left pleural cavity free. A recent black clot in both main branches of pulmonary artery. A gray embolus, 1 cm. long, in the branch leading to the lower lobe of the left lung. This was derived from the left common iliac vein, in which an adherent thrombus, as thick as the thumb, was found extending to the vena cava.

Peritoneum of intestines and mesentery covered with innumerable nodules; one nodule as large as a goose-egg. The ileo-cæcal region contains an especially large number of nodules.

The ovarian tumor is a nodular mass more than twice as large as a man's head, with numerous cysts, from the size of a bean to that of a goose-egg. The colon is imbedded in the tumor, and is excavated by polypoid tumor masses. No peritoneum can be found upon the uterus, which is firmly impacted in the tumor; its anterior and upper walls are converted into a cheesy pulp. No trace of the ovaries could be found.

Spleen enlarged and soft; liver, kidneys and bladder normal.

In the main, the tumor is firm, grayish white, in some places yellow and crumbling, or entirely softened. The cysts contain a light yellow fluid, mixed with glistening flakes.

The tumor consisted of a firm, connective tissue, areolar stroma. The cavities are round on transverse section, often elongated and occasionally anastomotic. They contain balls of a not very high cylindrical epithelium; almost all of the balls enclose a small central lumen.

The diagnosis of ovarian cancer is not very difficult in some cases. The majority do not come under treatment until a late period, and can then be diagnosed at least as malignant tumors, and in part as cancer. Our suspicions should be aroused by youthful age (about twenty years) and by the period of senile involution. Early cessation of menstruation, while the tumor is still small, is an important sign. Ascites, especially if the tumor is small, is always suspicious; early cedema of the legs even more so. The nodular character of the tumor, which is generally slightly movable, the bilateral character which is sometimes recognizable, and the tenderness, are the next most important data. If, at the same time, the uterus is immovable or there is a firm infiltration above the vaginal fornix or in the recto-vaginal wall, hardly any doubt remains. Nodular tumors, which are felt in the abdomen apart from the ovarian tumor, almost always dissipate every doubt. Swollen glands sometimes furnish an indication, although those which are infected directly by the ovarian tumor can only be felt, if at all, by rectal exploration with the half or whole hand.

Finally, the clinical history is completed by unusually rapid emaciation and cachexia.

The case referred to on page 367 also shows the possibility of giving a graver prognosis than necessary. The marked ascites (sixty pounds) of the patient with a small tumor had led me to suspect a malignant growth. But as exhaustion and other evidences of such a tumor were absent, I first decided on laparotomy as an exploratory incision and found a quite solid tumor, which was easily removed, proved on examination to be a parvilocular cystoma, without any suspicious characteristics.

I have also seen other cases in which the extremely cachectic appearance of the patient and other symptoms had excited the suspicion of ovarian cancer, but this was not verified on laparotomy. In one case the yellow, sallow complexion of the patient was the result of profuse intracystic hemorrhage in torsion of the pedicle, as was also true of another case.

The prognosis is absolutely fatal. Even in the most favorable event, if the ovarian tumor is extirpated completely and no metastases can be discovered, a rapid return appears to be the invariable rule. Thus, Fleischlen reports that relapses occurred in each of the four cases of glandular cystoma mentioned above. This is corroborated by my own experience.

Treatment offers very little chance of permanent results. Nevertheless we should not hesitate to extirpate an ovarian cancer if metastases are not present. Inasmuch as an entirely certain diagnosis of cancer is rarely possible, unless metastases upon the peritoneum are demonstrable, we should proceed to laparotomy after the mere diagnosis of ovarian tumor, and, after the incision has been made, the tumor should not be left behind if it appears susceptible of complete extirpation.

The question of extirpation assumes a different aspect when metastases are recognizable. If they are few and situated in favorable localities, we should not fail to remove them, especially as their histological character is not always assured at the operation. Thus, in a case of bilateral ovarian tumor, as large as a child's head on each side, I removed a metastasis, the size of a hazel nut, which was situated on the tube. The tumors proved to be endotheliomata. The patient died $2\frac{1}{2}$ years later with the symptoms of spinal disease (metastasis). A year and a half ago I extirpated a bilateral, subserous, papillary tumor, and, on account of a small metastasis, resected the uterus without opening into its cavity. The nature of the tumor could not be determined with certainty, but no relapse could be discovered a year after the operation.

Extirpation must be abandoned when there are numerous metastases on the peritoneum or omentum, still more on the intestines. Nor would I perform the operation if I found only a single metastasis on the bladder and gut, and would be compelled to resect both organs. In a case of this kind, however, Billroth removed all three tumors with at least temporary results.

Formerly a simple incision in ovarian cancer was almost always followed by a rapidly fatal termination. At the present time, under antiseptis, a patient rarely dies from such an operation, even if numerous peritoneal metastases and bloody ascites are present.

Puncture of the complicating ascites is the most important palliative measure. It usually becomes necessary at short intervals, but may afford great relief to the patient and prolong life by improving sleep and appetite.

TUBERCULOSIS OF THE OVARY.

This condition is rarely found. It occurs mainly in the cheesy variety, forming large, usually softened foci. Klebs mentions three or four cases, which were associated with adhesive peri-oöphoritis. "In con-

trast to tuberculosis of the uterine and tubal mucous membrane," says Klebs, "this affection is rare and is never associated with the former, so that it can not be regarded as the starting-point of the ovarian tuberculosis. Hence, the infectious matter can only be carried to the ovary through the blood-vessels, and it should be expected that general miliary tuberculosis would not spare any organ which is, at times, so vascular. But Klebs thinks that we can form no opinion concerning their frequency, because these tubercles are not visible macroscopically.

Scanzoni found in one ovary a number of partly gray, partly yellow tubercles, as large as a poppy-seed, and softened here and there.

In one case Rokitsansky observed, in addition to pulmonary and intestinal phthisis, peritoneal and tubal tuberculosis, numerous cheesy tubercles in the left ovary, the peripheral ones being situated in the albuginea. Only a small number were situated in the right ovary.

Contrary to Kleb's statement, tuberculosis of the ovary has been observed repeatedly in combination with that of the other genitalia. Guserow mentions two cases. In one both ovaries were as large as a hen's egg, and infiltrated with numerous cheesy nodules and softened masses; in the second case the ovaries were only as large as a pigeon's egg. The uterine mucous membrane was the seat of disease in both cases.

Among Talamon's ten cases of genital tuberculosis in girls under fifteen years, the uterus was affected nine times, the ovaries five times.

Among forty-six cases of genital tuberculosis collected by Mosler, there were seven cases of ovarian tuberculosis.

Spencer Wells describes a cystic ovarian tumor in which Fox found tuberculosis: on the outer surface of the simple cyst numerous nodules, as large as a grain of pepper and as hard as cartilage, were found "beneath the peritoneal covering" and firmly connected with the surrounding tissue of the cyst wall. The periphery of the nodules was shining and semi-transparent, the centre opaque and cheesy. The nodules were destitute of vessels. In their vicinity were delicate false membranes, strewn with miliary tubercles. Similar granulations as large as a poppy seed were situated on the cyst wall.

Baumgarten has described a similar affection in a tumor removed by Dohrn from a girl of fifteen years: the peritoneum was cloudy, reddened, and infiltrated in many places with small, yellowish white nodules. The surface of the large ovarian tumor was covered with innumerable nodules from the size of a poppy-seed to that of a pea, and sharply defined, plate-shaped thickenings. The majority extended only to the upper layers of the wall, many more deeply; some were almost entirely within the wall. The smallest nodules were transparent, with a yellowish centre in some the larger ones were opaque and yellowish. The smallest ones presented the structure of epitheloidal and giant-cell tubercle.

Numerous giant-cell tubercles, with a cheesy centre, were found in the tube. No bacilli were found.

The Prague Pathological Museum also contains a preparation of an ovarian cyst with tubercles on the inner surface. The infection seems to have started from the tuberculous uterus.

CHAPTER XLVIII.

CASTRATION.

CASTRATION of the female is a new operation in surgery. The term is applied to the removal of normal or relatively normal ovaries, which are not enlarged by new growths.

This definition of the operation has not, to our knowledge, been hitherto made, and there is great confusion with regard to the use of the term. Hegar applies it to the extirpation of small tumors of all kinds, and claims the right to define the term because he was one of the first to employ the operation. But he forgets that the extirpation of ovaries, degenerated by neoplasms, was long ago called ovariectomy, and that it can only lead to confusion to describe the removal of small tumors as castration. As a matter of course it would be impossible to tell what size the tumor must attain to warrant the term ovariectomy.

It would readily suggest itself that the purpose of the operation should be taken into consideration in defining the term, and that extirpation should be called castration only when its final object is the cessation of ovulation. This will hold good for the large majority of all cases, although Hegar claims that too much stress is laid upon this object of the operation. But there are cases in which the menopause is not the result sought for, *viz.*, those rare cases in which a displaced, but otherwise normal or only secondarily changed ovary is extirpated on account of the irritative symptoms produced by its abnormal position (hernia or descensus ovarii). According to this definition, therefore, we would be compelled to apply the term ovariectomy to the extirpation of one or both unenlarged ovaries which had descended into Douglas's sac; this does not seem to me to be proper.

It must be admitted that the use of the correct terminology is embarrassing in some cases. This is especially apt to occur in simple cystic dilatations of the follicles. But if an undoubted neoplasm (cystoma, dermoid, solid tumor) is present, extirpation is performed mainly on account of the new growth, whatever its symptoms may be, or even if symptoms are entirely absent.

It was necessary to give a more precise definition of castration, partly in order to be able to review the operations hitherto reported, but chiefly in formulating the indications. When a new growth is present, this *per*

se constitutes the indication for operation, while in cirrhosis or hyperplasia of the stroma, in irritative conditions of the surface or parenchyma of the organ, the operation is indicated by the severity of the symptoms and not by the disease, which is *per se* innocuous.

HISTORY.

Apart from the few cases of extirpation of ovaries situated in hernial sacs, the first operations were performed in 1872 by Hegar (July 27), Lawson Tait (August 1), and Battey (August 17), independently of one another. Hegar castrated an opium eater. The indication consisted of intolerable neuralgias, associated with considerable disturbance of the general condition. One ovary contained a cyst as large as a small hen's egg, the other was very little changed. The patient died of septic peritonitis. Hegar's and Tait's cases were not published at the time. Battey reported his first case in 1872, and nine others in 1876. He operated chiefly in menstrual disturbances, ovarian neuralgia and various neuroses; in some cases the ovaries were normal, in others in a condition of chronic inflammation and adherent to surrounding parts. He first called the operation "normal ovariectomy," in order to indicate that there were no gross changes in the organs.

The operation has not been adopted in Germany as extensively as in the United States and Great Britain, although Hegar advocated it by his example as well as by numerous important publications.

Battey's first case was that of a patient suffering from amenorrhœa and severe molimina menstrualia, perhaps dependent on peri-*oöphoritic* processes. In his other cases the indications were furnished by ovarian neuralgia, menstrual disturbances, severe cerebral symptoms, such as epileptiform attacks, etc. In 1823 James Blundell had suggested extirpation of the ovaries in similar conditions, basing the idea on experiments on animals which had led him to regard the operation as feasible.

Peaslee added a new indication in operating when the function of the ovaries was intact, but the uterus presented developmental anomalies (uterus bicornis and atresia of both horns).

The most important addition to the indications was made by Trenholme and Hegar, who performed castration in uterine myomata in order to abolish menstruation and profuse uterine hemorrhages with ovulation, or, as Hegar expresses it, to anticipate the menopause. A few of the first operators extirpated *per vaginam*; almost all others have operated exclusively by laparotomy.

THE SIGNIFICANCE OF THE OPERATION TO THE ORGANISM.

The relations of the ovaries to the development and functions of the organism have been critically investigated by Hegar. His views are based

on the examination of cases of defective or rudimentary development of the ovaries, the conditions found in hermaphroditismus transversalis of both kinds and hermaphroditismus lateralis, the results of castration of female animals, and finally the observations made in the human female after bilateral ovariectomy or castration.

The conclusion reached is that the removal of the organs in the adult has no direct and decided influence on the body and its female type, on the character of the pelvis, breasts and external genitalia, and that even the feminine mental habitus and sexual desire do not usually suffer.

But the uterus, as it seems, always becomes rudimentary, while the vagina is less affected by the hypoplasia. The most important and almost constant result is the cessation of menstruation, and, as a matter of course, of the *facultas concipiendi*.

In addition, we may refer to menstrual molimina, vaso-motor disturbances and various slight consensual and reflex symptoms, together with an increased tendency to obesity, symptoms which may develop in a more or less marked degree at the natural menopause.

According to Hegar, we cannot tell at present to what extent these symptoms are more constant and pronounced than at the natural climacteric. From my limited experience it has seemed to me that the vaso-motor disturbances, especially the feeling of heat, perspiration and vicarious hemorrhages, and the tendency to embonpoint, are more constant and pronounced after castration than after the natural involution.

A question which has not been discussed hitherto, is: What is the effect of artificially premature involution of the genitalia on the senile involution of the body? Observations on women who spontaneously cease to menstruate at an early period might permit some speculation on the subject. I do not refer to those women in whom menstruation ceases at the age of forty, associated with premature general involution, but I refer only to those not very rare cases in which, despite the youthful body, menstruation ceases at the beginning of the thirties or even in the twenty-eighth year. The number of castrations in the second and third decennium is not sufficiently large to permit an answer to our question, but it is well to direct our attention to the subject, although it is probable *à priori* that the answer will be in the negative.

INDICATIONS.

Hegar sets up the following general indications: "Anomalies and diseases which are a source of immediate danger to life or will terminate fatally in a short time, or will result in protracted, progressive marasmus, interfering with the duties of life. It is presupposed that milder measures promise no success or have been employed without benefit, while the removal of the ovaries will relieve the disease." Nothing can be said in

opposition to this statement, although it merely expresses truisms which hold good equally with regard to all operations that are not of a mild character. In other words, castration should only be performed when the risk of the operation is proportionate to the probability and degree of the expected gain for the health or life of the patient. If the health is greatly impaired, so that the patient is tired of life, the operation is so much more justified, even if it appears especially dangerous and the result is not entirely assured. But the more endurable life is to the patient the more cautious we will be in performing the operation. In every case the danger of the operation and the chances of success must be conscientiously weighed, while, on the other hand, we are also justified in considering what value the patient will attach to life without an improvement in her health. As a matter of course the patient is entitled to an opinion on the question of operation. Hence, in a large number of cases, the final decision on the question of operation will not depend solely on the results of our medical examination of the case.

But the chief importance attaches to the special indications, to which we will now turn our attention.

The following are the indications:

1. Ovarian hernia in cases of severe symptoms or dangerous conditions resulting from the hernia, if reduction is unsuccessful. This indication is undisputed, and has already been discussed in Chap. III.

Inasmuch as ovarian hernia is unilateral, as a rule, unilateral castration is usually sufficient. Bilateral castration was performed only in Pott's and Litzmann's cases.

Descent of the ovary may resemble hernia as an indication for castration, if the displacement causes notable symptoms and can not be relieved in any other way.

Lusk, Savage, Pernice and others have operated in such cases. In Pernice's case the ovary, which was situated on the floor of Douglas's sac, was very tender on pressure. Pressure upon it produced vomiting at once. The patient suffered from severe pains and had had two attacks of peritonitis; pessaries were not tolerated. The descended ovary was removed, the other was allowed to remain on account of great technical difficulties in the operation. The results were very good.

Such cases are not very common. But that the indication is correct has been proven to me recently by a case in which the symptoms are very severe, and the failure of all other methods of treatment has led me to think of extirpation.

2. The second indication is: absence of the uterus or a rudimentary condition of such a character that the menstrual secretion is made impossible, although ovulation exists and gives rise to menses and other disturbances.

In order to avoid mistakes and failures we must remember that the

on the examination of cases of defective or rudimentary development of the ovaries, the conditions found in hermaphroditismus transversalis of both kinds and hermaphroditismus lateralis, the results of castration of female animals, and finally the observations made in the human female after bilateral ovariectomy or castration.

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do not stop at all after the operation, in others only for a few months, and the tumors continue to grow.

The proper field for castration is afforded by interstitial tumors, which have not enlarged the uterus beyond the dimensions of the fourth month of pregnancy, and in which menstruation still presents periodicity, though perhaps of an anticipating type.

In such cases, as a rule, immediate and permanent amenorrhoea follows castration, and there is very often a rapid and marked involution of the tumor. But even in these most favorable cases myomectomy is constantly gaining the ascendancy. It is particularly in those myomata which give rise to uniform enlargement of the uterus, that supra-vaginal amputation can be performed in a typical manner. The danger of myomectomy is constantly lessening, and, if I mistake not, will soon have reached almost the certainty of ovariectomy.

But when the extirpation of myomata is dangerous on account of extensive development in the broad ligament and on the floor of Douglas's sac, castration is likewise attended with uncertain results. This fact favors the view (expressed by Hegar and Schroeder) that, apart from the cessation of ovulation, castration is effective in myomata by the ligature of the vessels. Hence Anna advised the ligature of the vessels as the principal operation.

It must be stated, however, that Hegar and Winckler regard castration as very successful even in large myomata and subserous development of these tumors, and confine the indications for myomectomy to pedunculated and cystic myomata. I believe that the time has not yet come for arriving at a proper conclusion.

In cases which are adapted for castration some operators prefer this operation, others myomectomy, and some will be unable to arrive at a positive decision in favor of one or the other. In some cases the decision must be reserved until the abdomen is laid open. The dangers of both operations can then be judged more accurately. In Hegar's first two operations on account of myomata the substitution of one operation for the other took place. He had intended to perform myomectomy, and on the recommendation of Schuchard of this operation had him to perform castration.

The same case has also been observed. Thus Hegar performed supra-vaginal amputation when he found himself unable to reach the hemorrhaging vessel. The various indications of castration are sometimes in such a group, that it is almost impossible when the vessels are peduncled and well exposed to the uterus and at the same time there is an extensive development of myomata, to reach the decision of the operation on the basis of a comparison of the advantages and disadvantages. In such cases the indication for supra-vaginal amputation is usually indicated by the fact that the tumor is not peduncled, and the vessels are not well exposed.

As a general thing, however, we can recognize in advance whether myomotomy will be attended with special difficulty, while the indications of obstacles to the performance of castration are more apt to escape notice until the abdominal cavity is opened.

Personally I prefer myomotomy as the more certain and hardly more dangerous operation in cases in which typical supra-vaginal amputation is possible, *i.e.*, when the cervix is narrow and accessible, and there are no extensive intestinal adhesions. But I can also testify from my own experience that castration may be attended with very excellent results.

Other affections of the uterus are of secondary importance. First come hemorrhages, dependent on benign diseases of the mucous membrane, which have been unsuccessfully treated in other ways. Some cases of fungous endometritis are so obstinate that ordinary treatment has only a temporary effect, and, after fruitless efforts for years, castration may be justifiable, at least if the woman is not very far from the menopause. Hofmeier operated in a case of this kind. Even without disease of the uterine mucous membrane, heart disease or any other causative organic affection, uterine hemorrhages sometimes occur of such a protracted character that a serious operation is justified. The periodical occurrence of such hemorrhages usually characterizes them as menstrual. The prospect of complete success from castration is then so much more certain. In a case of this kind, in a widow aged thirty nine years, I performed castration with the most favorable results, both as regards the hemorrhages and the general condition.

Kleinwaechter regards membranous dysmenorrhœa in older women as a similar indication for castration in exceptional cases. The obstinacy of the disease and the severity of the symptoms may justify castration in exceptional cases, but the normal condition of the patient in the intermenstrual period will militate seriously against such an operation.

But in all such conditions castration will only be justifiable in exceptional cases after years of suffering and when the patients are no longer young, the fact being taken into consideration that the operation is almost always free from difficulty in such cases.

Among other uterine diseases we may mention retroflexion. In a case of retroflexion with symptoms of threatening ileus, Koeberlé long ago performed laparotomy, and, after removal of the one healthy ovary, fixed the uterus to the anterior abdominal wound. This was a castration *de facto*, but not in the true sense. Odebrecht and Boerner have since operated for retroflexion, but in Odebrecht's case there was also peri-*o*phoritis, so that the indication was not based solely on the displacement. Both patients recovered from the operation, Odebrecht's only after several complications, such as parotitis and pelvic abscess. The result remained satisfactory after a short period of observation. Hegar operated very often in retroflexion.

But in conditions of this kind, in young women, the indication must always be considered most carefully, because very much depends, not alone on the proper selection of the case, but also on other methods of treatment.

In retroflexion, when other treatment has been useless and the disease is severe, operative anteversion of the uterus, either by stitching the uterine ligaments to the abdominal wall or by Alexander-Adam's operation must also be taken into consideration. Assuming that these operations would be successful—and this cannot be maintained in view of our slight experience—they are more rational than castration. They act directly against the primary affection, while castration only acts by the abolition of ovulation, and therefore never offers a full guarantee of complete success. Castration will be indicated even less frequently in ante-flexion or other displacements of the uterus.

4. A further indication is chronic oöphoritis and peri-oöphoritis, or, as Hegar expresses it, chronic inflammation of the tubes, pelvic peritoneum and parametrium, either resulting primarily from pathological processes in the ovary or at least kept up by ovulation. In fact we must combine the inflammations which are situated primarily in the ovaries and the undoubtedly more frequent ones which start from the tubes, because a positive differential diagnosis cannot be made in the majority of cases. But when Hegar separates, as an entirely distinct affection: "The affection of the ovaries characterized by small cyst degeneration of the ovaries, proliferation and retraction of the stroma," and attributes to these conditions, in a certain number of cases, the most distressing symptoms, such as fixed and radiating pains, menstrual disturbances, various neuroses (neuralgias, vomiting and cardialgia, epileptiform attacks, spasms of various kinds, hemiplegias), we recognize in these symptoms only those which complicate oöphoritis and peri-oöphoritis, or those of hysteria complicated with ovarian neuralgia. I regard the changes mentioned essentially as sequelæ of irritative processes in the vicinity of the ovary. That the dilatation of a few follicles, the hyperplasia of the stroma and cirrhosis, may produce such an array of symptoms is entirely unproven and *à priori* very improbable.

Castration acts in peri-oöphoritic processes by producing the menopause, but we cannot look forward with certainty to a successful result.

Hegar attaches great importance to the above-mentioned changes in the ovary. They alone afford him the indication for operation when severe nervous symptoms are present. But this author also says: "we have several times obtained permanent results from castration in cases in which careful examination showed, apart from slight peri-oöphoritis, merely hyperplastic conditions of the stroma of the ovary."

We then ask: What remains of the anatomical basis which Hegar repeatedly declares as indispensable to the indication? Has Hegar, in his

numerous castrations, always diagnosed these conditions as morbid changes in the organs? And, if he has relied upon his diagnosis of these changes, how often has he erred? Has he not taken the indication from the combination of the clinical symptoms, from the constant tenderness of the organ, the excitation of the pains in this part, the exacerbation of the symptoms by the menstrual congestion, and the mode of development of the disease? We cannot remain in doubt on these points, particularly as Hegar adds: "we must be able to show that the fixed or radiating pains do not start from some organ in the vicinity of the ovary and are not projected excentrically. Furthermore we must show the dependence of the consensual symptoms on the ovary in the previously mentioned manner. With regard to the menstrual disturbances we may be satisfied with excluding some important constitutional disease, which has given rise to them primarily. On the other hand it is less important to know whether these symptoms start primarily from the ovaries or perhaps take their origin in the uterus."

I agree fully with this statement. The difference between Hegar and me consists only in the fact that the former, when he finds a few prominences on the ovary, or feels that it is firmer and somewhat thicker, or, on the contrary, smaller than usual, satisfies his anatomical conscience, while I, after having ascertained in the same way the dependence of the symptoms on the ovaries, at the most regard the often minimum anatomical changes as a corroboration of my opinion, but recognize the fact that similar symptoms may develop without any changes in the ovary which are clinically recognizable. But an indication can not be offered by changes which are only recognizable on the *post-mortem* table or in the extirpated organ.

Certain circulatory disturbances are probably much more important than the ovarian tissue changes upon which stress is laid by Hegar and others. This opinion is supported by the fact, mentioned by Hegar, that castration has an especially favorable influence in marked dilatation of the veins of the spermatic and uterine plexuses. This varicocele muliebris, in which the broad ligaments contain large bundles of veins almost as thick as the finger, is especially frequent in uterine myomata, and is not rare in ovarian tumors. Hegar states that he has also seen it often in changes of the ovarian stroma and small cyst degeneration, and his remarks concerning the attendant symptoms appear to us very plausible. The diagnosis of this varicocele is less certain, and is often impossible beyond the mere suspicion.

But severe symptoms sometimes result from other ovarian changes which are never clinically recognizable, and therefore Hegar's requirement that the indication for castration must always consist of demonstrable anatomical changes in the genital apparatus, does not appear to us to be justifiable. This requirement only holds good on paper. Hegar's

own cases show that, in order to hold fast to this requirement, he grasps at straws.

To recapitulate: there are undoubtedly changes in the ovaries, clinically unrecognizable, which may give rise to severe and protracted morbid symptoms, and castration may be indicated even if anatomical changes can not be proven.

In this we do not agree with Hegar, and it is readily understood that all investigators may not be of the same opinion concerning questions which Hegar himself regards as unusually complex and obscure in certain respects. This does not justify Hegar in charging all, who do not agree with him, "with insufficient acquaintance or imperfect comprehension of the literature."

From these remarks it is evident that the indication is never more obscure than in cases of the kind mentioned, both in those which present marked symptoms of chronic oöphoritis or peri-oöphoritis (exudation, fixation or displacement of the ovaries, enlargement and changes in the shape of the organ, etc.), and in those in which such anatomical changes are evidently absent.

In the former it is easier to determine that the ovary constitutes the seat of disease, but it is more difficult to determine whether castration will produce the desired cure or even improvement; at the same time these are the most difficult cases technically, in which the surgeon has often been unable to complete the operation. We must therefore consider whether the danger of the operation is overbalanced by the results. The uncertainty of success in these cases depends in great part on the fact that the ovaries are often affected only secondarily and slightly, that their removal, even if complete, does not remove the real seat of disease, and that the mere abolition of ovulation is insufficient to produce a cure of the process or to prevent the constantly recurring hemorrhages. The disease is often located in the tubes, and Lawson Tait is not far out of the way when he claims that their removal is the main point in such cases. But the complete extirpation of both tubes makes the operation more difficult, and, at the same time, much more dangerous.

In those cases in which anatomical changes cannot be discovered, the difficulty of making the indication resides in the difficulty of the differential diagnosis between a primary irritative condition of the ovaries and one which is projected excentrically from the central organs, between oöphoritic processes in the widest sense and ovaralgia. In the latter affection castration is of as little benefit as the extraction of the teeth in trigeminal neuralgia.

How difficult and intricate the cases may be, and, at the same time, how beneficial castration, I will show by the report of a case.

5. The final indication is afforded by severe nervous and mental diseases, which stand in a close etiological relation to the sexual functions.

There are undoubtedly cases of serious nervous diseases (spasms of various kinds, epileptiform attacks, true epilepsy, psychoses) which are intimately connected with the sexual functions or in which these symptoms are the direct result of the processes of menstruation and ovulation.

In all such cases we must ascertain whether the neurosis is really reflex and has not been converted secondarily into a stable disease of the central nervous system, which cannot be relieved by castration. As a matter of course, the question of castration will only arise in grave morbid conditions, especially severe forms of hysteria, hystero-epilepsy, epilepsy and psychoses. Hegar's doctrine that, even in such cases, demonstrable anatomical changes in the sexual organs are a necessary condition for castration, is in opposition to that of many other writers and to experience. Hegar's cases show that he castrates in severe nervous diseases when the ovaries are healthy, but the uterus is retroflexed. But he claims that castration should not be performed if no anomaly is discovered in the uterus. May not the sexual processes in the healthy ovaries give rise to grave neurasthenic and psychical conditions? Is the uterus necessarily the intermediate link? Experience teaches that this is undoubtedly not true.

Leppmann says: "to declare perceptible changes in the genitals an absolutely necessary condition (as Hegar demands) will not appear satisfactory to alienists, because the latter are inclined to regard the normal development of puberty or the occurrence of menstruation as exciting causes, in predisposed individuals, of psychoses which are not less severe than epilepsy, and because a groping into uncertainty is permissible in an operation which still bears the stamp of an experiment."

In fact, our knowledge of nervous diseases is not by any means so far advanced as to enable us to demonstrate a definite etiology in every case, and hence castration will be attended with failures even if we always base the operation on pathological changes in the sexual organs.

When the dependence of the symptoms on the sexual functions has been rendered probable and other modes of treatment offer no chances of success, castration is as justifiable as it is on account of hemorrhages or other symptoms in myomata.

There are two circumstances in such cases which still further justify the indication for the operation. In the first place, there are few patients who feel so unhappy and tired of life as these unfortunate individuals; in the second place, the operation is relatively devoid of danger when the genitalia are normal or approximately normal.

In our previous remarks we have simply wished to maintain that there are rare cases of severe cerebral and spinal symptoms and psychoses, in which castration may be performed with great benefit even in the absence of local diseases of the genital organs, and the indication for the operation is based solely on the combination of the clinical symptoms.

We believe that Hegar's anatomical standpoint should be adhered to as much as possible in the classification of cases, but it is in this very respect that Hegar abandons his principle. He has recently reported thirty-two cases of castration in neuroses which are divided into three groups according to the nervous symptoms. But in half the cases there was retroflexio uteri, with or without fixation, in others ante flexion with fixation, in six cases pyosalpinx, in five cases ovarian tumors, in others thickening of the parametria by exudation. Why has he classified them according to the purely extrinsic principle of the symptom-complex? This should be reserved for those cases which cannot be defined anatomically.

CONDITIONS FOR CASTRATION.

Among the contra-indications of the operation three require special mention.

1. There should be no acute inflammation present at the time of operation.

2. The patient should not be near the menopause. From a practical standpoint, however, it is to be remembered that the period of the menopause is very variable, and is often delayed very long in women suffering from myomata. In cases of interstitial and sub-mucous myomata the menses very often continue regular until the age of fifty, even fifty-three or fifty-four years, and occasionally to the age of fifty-eight years.

Hence, it is especially when castration is to be performed on account of hemorrhages in myomata, that the age at which the operation is still admissible is not to be adjudged too low. Even in a woman of forty-eight to fifty years, the restoration of health might occur eight to ten years earlier than it would spontaneously. Other indications will hardly ever justify the operation at such an age.

3. Hegar requires as a further condition that the ovaries must have been palpated before the operation. This condition is intended to prevent failure in finding the ovaries during the operation. As a matter of fact this has often occurred, particularly in myomata, in which the ovaries occasionally cannot be discovered upon the irregular tumor, especially when our view is interfered with by the firm abdominal walls and the immobility of the tumor. There are also many cases in which the ovaries could not be extirpated, either because they were inextricably imbedded in exudation or had such a position that their removal could not be carried out. Hence, the palpation of the ovaries before the operation is not an absolute safeguard against the failure of the operation. It must also be remembered that, as a matter of course, it is easier to find the ovaries after laparotomy than to feel them through the abdominal walls, and there are undoubtedly a number of cases in which it is impossible to

discover the ovaries before the operation—for example, when they are situated on the posterior wall of a moderately large myoma, but in which they can be readily found on operation and extirpated.

Hence, I do not regard this contra-indication as valid in all cases. In myomata of moderate size, in which the uterus is not larger than at the fourth to fifth month of pregnancy, the ovaries can always be discovered after opening the abdominal cavity, but not always in much larger tumors. In the latter, however, the effects of castration are still doubtful.

The discovery of the ovaries may also be difficult in perimetritic and parametritic processes with extensive exudation, and preliminary palpation is therefore desirable. In myomata and parametritic processes, a dilated tube or small subserous myoma is apt to be mistaken for the ovary.

THE RESULTS OF CASTRATION.

The most important result is amenorrhœa, which in the large majority of cases occurs at once and is permanent. A slight uterine hemorrhage, lasting several days, is observed not infrequently a few days after the operation. It may last a few hours or days, but is hardly ever profuse.

The amenorrhœa occurs at once and permanently in about three-fourths of the cases; in another series of cases it does not appear until the lapse of months, during which periodical or irregular hemorrhages continue; in rare cases, finally, the menopause does not develop for years.

The immediate menopause remains absent most frequently in periophoritic processes, especially if more acute inflammation or abscesses develop after the castration. As a general thing, also, the menopause does not occur in cases of submucous myomata, whose structure approaches that of polypi. Indeed, profuse hemorrhages may occur in such cases.

In a certain number of cases the continuance of menstruation is the result of leaving behind a portion of the ovarian parenchyma; this is avoided with much greater difficulty in castration than in ovariectomy.

On the other hand, the remote possibility of the presence of a third ovary, or of deception on the part of the patient, plays no part in the tolerably frequent cases of continued hemorrhages.

If we bear in mind that in the large majority of cases castration is followed by the complete menopause, but that there are exceptions to this rule, despite the undoubtedly complete removal of both ovaries, it seems to me to prove that the connection between ovulation and menstruation is very intimate but not immediate. The efficient cause of both processes is to be sought in the nerve centres, but menstruation, as a rule, depends on the functioning of the ovaries and will occur only exceptionally without this intermediate link. In all probability ovulation produces menstruation through the medium of the spermatic plexus. Irritations

of these nerves, resulting from inflammatory processes, exudations, etc., have kept up menstruation in a number of cases after removal of the ovaries.

The further results of castration generally consist of vaso-motor disturbances. The chief ones are: a feeling of a rush of blood, flashes of heat over the body, outbreaks of perspiration, which are generally very acute. Pain in the back and head and other menstrual molimina are rarely observed.

These symptoms are not periodical but permanent, *i.e.*, they occur more or less often every day and sometimes last several years. In one of Hegar's cases they had not disappeared at the end of five years. The greater constancy and severity of these symptoms than after spontaneous cessation of the menses must be attributed to the suddenness with which castration interrupts the function of the ovaries, while the latter is extinguished gradually in senile involution.

In rare cases vicarious hemorrhages from the stomach or other organs occur after castration. A woman of forty-six years in whom, six years after ovariectomy, I extirpated the other and apparently healthy ovary on account of violent ovarian dysmenorrhœa, had not menstruated at the end of 1½ years after the operation, but had had three hemorrhages from the stomach which could not be attributed to an organic gastric affection. She also complained of frequent rush of blood, but remained entirely free from the old violent dysmenorrhœa.

Another patient, who was castrated on account of myomata, at first suffered from a continuance of the hemorrhages, but then lost them entirely for about six months. She was then attacked by spitting of blood, which occurred partly at regular intervals. This symptom then disappeared and she remained healthy. I did not observe the spitting of blood personally, so that I am unable to state whether it was an hæmatemesis or hæmoptysis.

TECHNIQUE OF CASTRATION.

Castration may be an extremely easy and also an unusually difficult operation. In normal position of the genitalia, very little or no enlargement of the uterus and no adhesions of the ovaries and surrounding parts, the operation is extremely easy, and, with strict antisepsis, almost entirely free from danger.

It may be very difficult if, in cases of myoma, the ovaries are almost inaccessible at the entrance to the pelvis, beneath the almost immovable tumor, which has developed from the fundus uteri, or when, in other cases, they are pressed close against the enlarged uterus by the unfolding of the broad ligaments, and at the same time stretched to twice their normal length, and when, furthermore, they are surrounded on all sides by large bundles of enormously distended veins. No less great difficulties

are encountered in perimetritic processes when the firmness of the adhesions not infrequently makes complete extirpation impossible, and, at the same time, favors injury to adjacent parts.

The increased danger of castration in these cases must be taken into consideration in forming the indication, although, as a general thing, the degree of difficulty of the operation can only be suspected before opening the abdominal cavity.

The operation is to be made according to the rules which obtain in ovariectomy. This is especially true of antisepsis, which must be carried out so much more strictly because, in the majority of cases, the healthy peritoneum appears to be especially adapted for the reception of infectious substances.

The incision through the abdominal walls is more difficult, bloody and tedious in all cases in which a large myoma is not present and closely applied to the abdominal walls. As the majority of the patients are nulliparæ, the abdominal walls are usually very resisting, not attenuated and very vascular. The inner borders of the recti are not separated from one another. Numerous vessels must therefore be provided with ligatures or artery forceps, and, as we approach the peritoneum, the operation must be performed with caution in order to avoid injury to a loop of intestine. It is therefore advisable first to expose the peritoneum for a length of 5 to 8 cm., to separate the præperitoneal layer, and then to raise the latter with forceps and make an incision with the knife, or to keep the gut away by means of two fingers and then to open upon the tips of the fingers with Cooper's scissors. The latter method, which I recommend warmly, is especially safe in case of insufficient experience or unusual difficulty, because the two fingers can easily distinguish the peritoneum and the underlying gut, while in raising a fold of the peritoneum with forceps the eye may be deceived as to whether the intestinal wall is grasped or not.

The linea alba is the best place for the incision. In rare cases the flank incision, employed by veterinary surgeons, is preferable. It seems to me that this incision is only adapted for cases of quite large, slightly movable myomata, in which both ovaries can be palpated immediately behind the abdominal walls. The greatest certainty that the ovary is really palpated is furnished, apart from the shape and mobility of the organ, by the ovarian ligament and tube, which are felt as a round cord.

In such cases we cut directly upon the ovary of each side, an oblique division of one or the other muscle being thereby made unavoidable. Despite the greater thickness of the abdominal walls, the more severe lesion of the muscles, and the double incision, the flank incision may be decidedly preferable, under the circumstances mentioned, to the median incision. But in thirteen cases of castration in myomata, I found the flank incision indicated in only one case.

If the uterus is not enlarged and the ovaries normally situated and non-adherent, an incision 8 cm. long usually suffices. But if a not very small uterine tumor is present, if the position of the ovaries is uncertain, if adhesions or other difficulties are looked for, the incision must be made large enough to admit the whole hand, and even this often proves insufficient.

After opening the abdomen we examine into the feasibility or difficulty of the operation. With relatively normal genitalia it is easy to find the ovaries by passing from each horn of the uterus along the posterior side of the broad ligament. If it is not situated here, it is generally displaced into Douglas's sac, in other cases above the upper edge of the ligament anteriorly. Before extirpating one ovary, the other should always be looked for. This rule is to be adhered to with special strictness in cases of myoma, because the finding or extirpation of the organ may encounter insurmountable obstacles, and the operator must then take the question of myomotomy into consideration.

If one ovary has been discovered in a case of irregularly shaped myoma, the direction in which the other is to be looked for is generally shown by the course of the ovarian ligament and tube. Important data are also furnished by examining the position of the uterine cavity before the operation.

After these points have been settled, castration is to be performed forthwith in simple cases. The operator draws out the ovary with the index and middle fingers, if necessary and possible, with the aid of rotation of the uterus on its long axis, so that the elongated connections of the organ, formed into a sort of pedicle, are situated in the abdominal wound. We must now decide whether the tube is also to be extirpated, and if so, to what extent. If the tube is diseased, distinctly distended with fluid, its almost complete removal is very desirable or even more necessary than the removal of the ovary.

But if the tube is undoubtedly healthy its partial or complete excision can only be indicated indirectly for technical reasons. When the ovary is separated from the tube by a sufficiently broad peritoneal reduplication, the tube may be retained. But if the space between both organs is very narrow, and, as is so frequent in myomata, the ovary is very much elongated by traction, the ligature and removal of the tubal ampulla and fimbriae can be effected more easily.

If possible, the ovary, with or without the lateral extremity of the tube, is merely grasped with the fingers, held by the assistant, and then the silk ligature applied as far centrally as possible, in order that a sufficient pedicle stump may be left after removal of the ovary. Hegar has devised a fenestrated forceps, provided with teeth, which is used to grasp the ovaries, but it almost always crushes the tissue on account of the insufficient concavity between the fenestrae. If the fingers do not

suffice, it is better to grasp the pedicle of the ovary with securely closing forceps.

The ligature can be applied less securely than in removing ovarian tumors, even if very small. A pedicle is only made artificially by the often considerable traction. After application of the ligature the stretched tissues are apt to draw out of the loop. Hence, extremely firm tying of the ligature is nowhere more necessary, and, for the same reason, silk is preferable to every other material.

But if the tissues are too narrow to permit the secure application of the ligature and, at the same time, the removal of the entire ovary, other means must be adopted. We may first tie the infundibulo-pelvic ligament separately, after the division of which the ovary becomes much more movable and can be ligatured much better; or a double ligature is carried through the artificially produced pedicle with a needle and then tied on both sides; or, after applying a single or double ligature, the peritoneal covering of the ovary is circumcised at the hilus and the organ then enucleated with blunt instruments, as described on page 257. The advantage of this enucleation depends upon securing a large mass for the stump of the pedicle, from which the ligature will slip with greater difficulty. During or immediately after division the stump of the pedicle should be grasped with a clamp, so that in the event of the slipping of the ligature, the pedicle can again be secured, preferably by perforating it with a double ligature.

Despite all our precautions we are often not sure, after removal of the ovary, that extirpation has been absolutely complete. If distinct cystic structures are visible on the stump of the pedicle, they are destroyed with the scissors or knife. If a minimum amount of ovarian parenchyma, which can not be recognized, is left behind, the firmly applied ligature will often cause its rapid destruction. But it is safer to destroy the remnants by the application of Pacquelin's cautery to the raw surface.

In the simplest cases of castration peritoneal toilette is almost always unnecessary, especially if we are sure that very little or no blood has entered the abdomen from the wound in the abdominal walls. In the large majority of cases, at all events, a brief toilette of the gut immediately behind the abdominal wound will suffice. To cleanse Douglas's sac and other remote parts after a brief and cleanly operation, would entail more danger than benefit.

The remarks made concerning abdominal suture in ovariectomy hold good here. The abdominal muscles can usually be included, without difficulty, in the sutures and a hernia thus prevented. The simple interrupted suture is the best method. The peg stitch is not advisable, because the abdominal walls are not less tense after the operation than before, and it is therefore not easy to throw them into folds. The number of deep sutures must be relatively large, because they are exposed to

greater tension after castration than after ovariectomy. The after-treatment is the same as that of ovariectomy.

The operation becomes very difficult when certain obstacles are present. Such cases may be divided into two classes, first, those in which the ovaries are imbedded in exudation, firmly adherent, often displaced, and complicated with hydrosalpinx or pyosalpinx; secondly, cases of myomata attended with complicating conditions.

Whenever the operation is unusually difficult the field of operation must be sufficiently exposed, and this is especially aided by suitable enlargement of the incision. But in the rigid, almost board-like abdominal muscles of some nulliparæ this does not suffice, and a transverse incision of the recti becomes necessary. Hegar properly recommended that the lower end of the trunk be elevated in order to throw more light into the pelvis. Finally, it may be necessary to keep the intestines in the upper part of the abdomen by means of cloths or sponges, or to draw them out of the abdomen.

The difficulties in oöphoritic exudations with or without tubal dilatation consist of the great difficulty in recognizing the relations. In many cases this is done completely only during the course of the operation, while at first we may not find the ovary or are unable to distinguish the tube, ovary, exudation or intestines.

When the adhesions are easily separated, it is best to divide them by blunt instruments, with the aid of the sense of sight. If they are firm, blunt separation must first be attempted unless there are adhesions to the intestines or bladder. The firmer the adhesions and the greater the force required in division, the more necessary is the control by means of the sense of sight.

If division by blunt instruments fails or appears to be hazardous on account of adherent hollow viscera, all the tissues which are to be removed should be ligated in parts, and the tissues within the ligatures removed with the knife or scissors. Beginning at the edge of the pelvis or the uterus, the ligating threads include the upper part of the broad ligament in the form of an arch. We must avoid going to the base of the ligament, where the ureter lies in dangerous proximity, and special attention is to be paid to the ligatures at the uterus and rim of the pelvis, because these ligate the vessels. The ligature which is next to the rim of the pelvis has the greatest tendency to slip off, and therefore the incision should not be made too close to it.

In this mode of operation the tube is removed with the ovary, and this is so much more necessary because relapses are apt to start from the tube. Dilatations of the tube, when they contain pus, demand especially careful treatment, in order to prevent rupture during the operation.

In myomata the difficulties are sometimes almost equally great. In the first place, it may be very difficult or even impossible to find both

ovaries. In three cases of myomata Leopold found both ovaries inaccessible, in one case on account of false membranes, in two cases one ovary could not be reached on account of its deep position in the pelvis. In seven published cases of intended castration the operation was performed completely in four, in two it was unilateral, in one it was entirely abandoned. Pernice was also unable, in a case of interstitial myoma, to remove the ovary, which was completely enclosed in false membranes. Nevertheless the result was good so far as the short period of observation permitted an opinion.

Among twenty-one castrations I was unable to find the right ovary in one case of interstitial myoma. The uterus, which was as large as at the fourth month of pregnancy, could not be displaced upwards or to the sides, and after a long search I abandoned extirpation of the second ovary.

A further difficulty results not infrequently from the position of the ovary, which, when the myoma develops from the fundus, may lie so deep in the pelvis that it is impossible to perform extirpation when the abdominal walls are rigid and the uterus immovable.

I have had two cases of this kind in which the difficulties were unusually great, though I finally succeeded in performing castration. The chief means of attaining our end is the suitable enlargement of the incision. Further aid is afforded by pushing the uterus forward, but this is often impossible. In great obesity or abnormal resistance of the muscles we have no adequate means of aid at our command. Even transverse incision of the recti then effects very little.

A further difficulty results, finally, from the close approximation of the ovaries to the uterus or tumor. As in pregnancy this is owing to the unfolding of the broad ligaments by the enlarged uterus. The difficulties are increased by the often considerable elongation of the ovary (sometimes three-fold). But the most serious difficulty then arises from the great development of vessels in the ligaments and the walls of the uterus. The ovary not infrequently takes part in this congestion. In no other condition do normal ovaries grow so large as they do occasionally in myomata. If we attempt with ligatures to isolate the ovary which is applied closely and broadly to the tumor, each insertion of the needle causes an often not inconsiderable hemorrhage; and this is repeated, if we apply new ligatures on the central side of the bleeding point. Clamps upon the large and firm uterine walls are useless. The actual cautery can not be applied on account of the profuseness of the hemorrhage, and compression with the fingers only helps so long as it is employed. Numerous ligatures are required, inasmuch as by them alone can we finally attain the desired end.¹ The loss of blood may be very consider-

¹ In the worst event, we must proceed to constriction of the cervix uteri with a rubber tube, check the hemorrhage, and perform myomotomy.

able, the abdominal cavity may be very much soiled, thus necessitating an elaborate toilette, which is usually very much impeded by the myoma, and increasing the tendency to shock.

RESULTS OF CASTRATION.

The mortality of the operation was unexpectedly large at first, although the operators had profited by their experience in ovariectomy. But the mortality diminished very rapidly, and will probably soon suffer a further reduction.

In 1881 Hegar published the following results: Among fifty operations he had seven deaths (14 per cent.); other operators had seventeen deaths (22.4 per cent.) among seventy-six cases. The mortality of all the cases was 19 per cent. Among 193 cases by numerous operators, collected by Fehling, the mortality was 18 per cent.; among 114 cases operated by Hegar, Tait, Bardenheuer, Tauffer and Fehling the mortality was 10.5 per cent.

Statistics of castration performed on account of myomata have also been collected. Mann reports nine deaths among thirty-eight cases; Wiedow reports fifteen deaths among 149 cases (eleven died from septic peritonitis).

From 1879 to 1885 I performed twenty-one castrations, of which four (19 per cent.) died, two from septicæmia, one from a relapse of peritonitis which had just run its course at the time of operation, one from pulmonary embolism on the eleventh day after the operation. The four deaths occurred in the first thirteen operations: since then all the cases recovered. The operation was performed thirteen times on account of myoma uteri with four deaths, while a fatal termination did not occur in any of the eight cases in which there were other indications for operation.

In comparing castration with myomectomy in cases of myoma, Thornton and Wiedow lay stress on the great mortality of the latter operation. But it must be remembered that statistics of this operation, which, like Fehling's statistics of castration, would include the results of only a few operators, would furnish a different result, inasmuch as myomectomy has made much greater advances of late years than castration.

With regard to the effects of castration on the symptoms of the patient, accurate data have only been obtained with regard to myomata. Goodell collated ninety-eight cases of castration in myoma. In seventy-eight cases amenorrhœa set in, in eight menstruation became less frequent, in twelve it continued. Wiedow's more recent statistics embrace seventy-six cases. In sixty-one cases the menopause occurred forthwith or after slight hemorrhage, in other cases the hemorrhages diminished, the tumor sometimes undergoing a diminution in size. In only four cases was the effect on the hemorrhage temporary or entirely wanting.

In the large majority of cases the tumor atrophied (sixty-three times in Wiedow's seventy-six cases). In three cases diminution in size was followed by renewed growth. In some cases the atrophy of the tumor is rapid and remarkably great. Tait observed the complete disappearance in six months of a tumor which weighed about five pounds.

I have also observed very rapid involution of a large myoma. The patient, aged thirty-nine years, had been confined to bed about a year and entered the hospital in a condition of extreme anæmia and weakness, with œdema of the skin, so that I did not dare to perform the operation until some time afterwards. The uterus was as large as in the seventh to eighth month of pregnancy. Three months after the operation the tumor had diminished to half its size, a year afterwards to $\frac{1}{3}$ its former volume. It remained at this size $4\frac{1}{2}$ years after the operation. Menstruation did not return. The woman was the picture of health and did hard labor in the fields.

I will now give a brief *résumé* of my twenty-one cases of castration.

1. Cases of myoma, thirteen.

The youngest patient was thirty years old, the oldest forty-five years. The indication in all was furnished by hemorrhages, which were excessive and threatening in some, and in all at least interfered in a marked manner with the patient's activity. Of the thirteen patients four died. The results as regards the menopause can only be given in eight cases, one being still too recent. In six the result was complete, the menses ceasing at once with the exception of one case in which three moderate hemorrhages occurred between the third to sixth months after the hemorrhage. In these six cases the amenorrhœa was found to persist at the end of $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3 and, in two cases, 5 years. In the seventh case the hemorrhages became very moderate, and health was restored. In the eighth case (a submucous myoma) only a temporary effect was observed. Then the hemorrhages became so profuse that it was necessary to perform amputation of the uterus a year after castration.

Among the cases in which immediate and permanent amenorrhœa set in, was one in which unilateral castration was performed, because the second ovary could not be found. Leopold describes a case in which neither ovary could be extirpated, and only a few vessels were tied, yet the uterine hemorrhage did not return.

2. Uterine hemorrhages without neoplasm, two cases. Both recovered. Age of the patients thirty-seven and thirty-nine years. The cause of the hemorrhage was obscure in both, although in one the beginning of myomatous new formations was not improbable. Both patients were unable to work and confined to bed for the greater part of the time. Other treatment had proven useless.

In the patient, aged thirty-nine years, amenorrhœa did not develop at once; the hemorrhage was almost constant from the sixth to tenth

month after the operation. Then they occurred at irregular intervals, and ceased entirely three years after castration. The general condition had improved decidedly in the first half year. In the patient, aged thirty-seven years, amenorrhœa occurred at once and was still present 2½ years later. She grew strong and healthy.

3. Ovarian dysmenorrhœa, one case, recovered. Six years before par-ovariotomy and ovariectomy had been performed on the patient, who was an unmarried woman of forty-four years. The very violent dysmenorrhœa was undoubtedly dependent on the other ovary. Menstruation and the chief symptoms ceased at once and permanently after castration. The extirpated ovary showed no macroscopical changes.

4. Neuroses and psychoses, five cases, no death. Two of the patients had been, for years, a burden to themselves and their family. They presented the history of hysterical psychosis with spasms and nervous symptoms of all kinds. No special connection between the symptoms and the ovaries could be discovered. The castrations were fruitless. At the present time I would not operate in similar cases.

Two patients of thirty-nine and twenty-five years, were sent to me from an Insane Asylum. The one, an unmarried woman of thirty-nine years, suffered from violent ovarian dysmenorrhœa, various neuroses, and was unable to take care of herself. She had been 1½ years in the asylum. After the operation the menses remained absent for five months, then three severe and three feeble hemorrhages occurred at regular intervals, then the menopause set in. The condition gradually improved and now (three years after the operation) is very good. The patient has again entered society, makes long trips, and has charge of her brother's household.

The other patient, aged twenty-five years, suffered from "hallucinatory insanity," and had been two years in Hitzig's Asylum. He thought that the dependence of the psychical affection on the ovarian function was unquestionable. No abnormality of the ovaries or uterus could be detected. The castration was followed at once by permanent menopause, but improvement of the mental disturbances was delayed. At the end of 1½ years, however, the improvement was very distinct, and it now seems as if the patient is on the road to permanent recovery.

The fifth case in this group is especially interesting. A girl of twenty-six years had been suffering severely for about ten years. She had had various symptoms, among others a paralysis of the lower limbs. When the patient came under my observation in 1881, the most important symptom was an attack of the most violent convulsions which occurred every evening at the same time. All the muscles of the trunk and limbs were involved. The attack lasted with great violence for half an hour and then slowly subsided. Consciousness was soon much improved from the beginning of the attack, and the patient had only an indistinct recollection

lection of what occurred during the seizure. The attacks were preceded by pains in the region of the left ovary, and these became much more violent after the attack. That they really started in the left ovary was shown by repeated examinations with and without narcosis. Palpation of the ovary was always followed by severe pain for several hours. The patient also had brief attacks of unconsciousness (*petit mal*), which occurred several times a day. All possible methods of treatment (including compression of the ovarian region) had been adopted without avail.

After the terrible epileptiform attacks had occurred every day for ten months, castration was performed on September 26, 1881. Since the operation not a single attack has occurred; the menopause set in at once. The attacks of *petit mal* became somewhat more frequent and severe for a few months, but in half a year they became less frequent and have now disappeared. The chief complaint of the patient, the violent ovarian pains, also disappeared, and her health improved in every respect. For years before the operation she could hardly walk unaided across the room, but a few years later she spent several weeks in Berlin, going from one Art Gallery to another.

The ovaries were entirely healthy, and peri-oöphoritic processes had not been detected during the operation.

This case shows very clearly the correctness of our statement that there are cases with severe cerebral and spinal symptoms in which, despite the absence of any demonstrable anomalies of the genital organs, castration may be performed with great benefit. Complete recovery in such cases often occurs very slowly, as was also shown in the two instances of psychoses mentioned above. The full effect of the castration may not infrequently be delayed by the molimina menstrualia, or, more properly speaking, the phenomena of rush of blood, which are almost constant at first and sometimes last for years after castration.

Hegar suggested long ago that the effects of castration may not appear until a late period. Savage claims that this occurs often in cases of ovarian dysmenorrhœa.

My last-mentioned case is not unlike those of Maeurer and Heilbrun. Maeurer castrated a girl of twenty-two years, who suffered from violent ovarian neuralgia and hystero-epilepsy. The attacks disappeared at once and had not returned nine months after the operation.

Heilbrun's patient, aged twenty-four years, had been confined to bed for seven years. The chief symptoms were obstinate vomiting, contracture of the left lower limb, part of the left upper limb, and the muscles of mastication; hyperæsthesia of the ovarian region, contact with which produced barking ructus. Speech was impossible on account of the contracture of the muscles of mastication. All the symptoms disappeared in five weeks after the operation, and at the end of ten months the patient could walk for an hour and a half. The extirpated ovaries were normal.

In our opinion the value of castration has been generally underestimated in Germany, while some exaggerate its value, and attach too little importance to its dangers. In myomata, in which these dangers are especially marked, castration is inferior in importance to myomotomy, and should be employed in only a limited number of cases. In ovarian dysmenorrhœa and in certain severe neuroses and psychoses the operation, with a proper selection of cases, is undoubtedly of great value in many cases and relatively free from danger. The final decision concerning the proper cases in these categories for castration must be left to further experience.

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